DECEMBER, 1957

modern castings

The Foundryman's Own Magazine

future meetings and exhibits

DECEMBER

1-6 . . American Society of Mechanical Engineers, *Annual Meeting*. Statler Hotel, New York.

3-4 . . Foundry Facings Manufacturers Association, *Annual Meeting*. Hotel Waldorf-Astoria, New York.

4-6 . . American Institute of Mining, Metallurgical and Petroleum Engineers, *Electric Furnace Steel Conference*. Penn-Sheraton Hotel, Pittsburgh, Pa.

5-7 . . National Association of Manufacturers, *Annual Meeting*. Waldorf-Astoria Hotel, New York.

6 . . Malleable Founders' Society, *Western Section Meeting*. Drake Hotel, Chicago.

9 . . AFS Nominating Committee, *Annual Meeting*. Union League Club, Chicago.

10 . . AFS Board of Awards, *Annual Meeting*. Union League Club, Chicago.

1958

JANUARY

13-17 . . Society of Automotive Engineers, *Annual Meeting*. Sheraton-Cadillac and Statler Hotels, Detroit.

17 . . Malleable Founders' Society, *Semi-annual Meeting*. Hotel Cleveland, Cleveland.

27-30 . . *Plant Maintenance & Engineering Show*. International Amphitheatre, Chicago.

FEBRUARY

6-7 . . Malleable Founders' Society, *Technical & Operating Conference*. Wade Park Manor, Cleveland.

10-14 . . American Society for Testing Materials, *Committee Week*. Hotel Statler, St. Louis.

13-14 . . AFS *Wisconsin Regional Foundry Conference*. Hotel Schroeder, Milwaukee.

16-20 . . American Institute of Mining, Metallurgical & Petroleum Engineers, *Annual Meeting*. Hotels Statler and Sheraton-McAlpin, New York.

20-21 . . AFS *Southeastern Regional Foundry Conference*. Patten Hotel, Chattanooga, Tenn.

24-25 . . AFS Board of Directors, *Annual Meeting*. Ponte Vedra Hotel, Ponte Vedra Beach, Fla.

MARCH

12-13 . . Foundry Educational Foundation, *College-Industry Conference*. Hotel Cleveland, Cleveland.

17-18 . . Steel Founders' Society of America, *Annual Meeting.* Drake Hotel, Chicago.

APRIL

13-18 . . American Chemical Society, *Spring Meeting.* San Francisco.

14-16 . . American Institute of Mining, Metallurgical & Petroleum Engineers, *41st National Open Hearth Steel Conference.* Statler Hotel, Cleveland.

14-18 . . American Welding Society, *Annual Meeting and 6th Welding Show.* Statler Hotel, St. Louis.

MAY

19-23 . . American Foundrymen's Society, *62d Annual Castings Congress & Foundry Show.* Public Auditorium, Cleveland.

JUNE

12-13 . . AFS *15th Annual Chapter Officers Conference.* Hotel Sherman, Chicago.

19-21 . . AFS *3d Annual Foundry Instructors Seminar.* Case Institute of Technology, Cleveland.

22-27 . . American Society for Testing Materials, *61st Annual Meeting.* Hotel Statler, Boston.

Safety Council Gives Tips on Working with Abrasives

■ Precautions to be observed in sanding, or grinding and polishing operations have been issued by the National Safety Council. The data sheet applies to both industrial and do-it-yourself projects.

Among the recommendations are:

■ Polishing, sanding, grinding, or similar operations creating a spark hazard should not be undertaken near flammable liquids, or in areas where explosive dusts are present—unless special precautionary measures have been established.

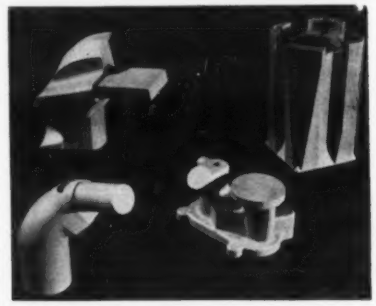
■ When it is mechanically impossible to guard the abrasive—which may be in the form of a belt, disk or drum—it may be desirable to provide the operator with a protective apron, gauntlet-type gloves and a face shield.

■ Coated abrasives stored in hot, dry places may dry out and become brittle, and thus become far more subject to breakage.

■ Protection that would be used on any machinery should be provided—V-belts, chains and gears should be covered, as well as couplings and projecting shafts. Motor frames should be grounded.

New Technique May Widen Castings Use in Aviation

■ Improved mechanical properties of aluminum investment castings may lead to increased use of castings in the nation's aviation program. The added strength and ductility obtained in the new "Supercast" process will permit designers to use aluminum investment castings as structural, load-carrying parts, subject to shock and impact.



Castings show complex shapes available with new technique.

The process is said to permit the casting of shapes which previously had to be machined or forged.

The development has been announced by Arwood Precision Casting Corp., New York. Details of the process have not been revealed.

The improved properties obtained by the new process are compared with Aeronautical Material Specification 4260 in the table below.

	AMS 4260	New Process
Tensile strength	24,750 psi	34,000 psi
Yield strength	16,500 psi	25,000 psi
Elongation	0.7%	3.0%

In areas designated as critical, Arwood can raise these guaranteed properties to tensile strength, 38,000 psi; yield strength, 27,000 psi; and elongation, 5%.

German Foundrymen Tour

■ West German malleable iron producers will make a tour of foundries in the United States. The foundrymen are members of the German Foundry Association which sponsored the 1956 International Foundry Congress at Duesseldorf. Arrangements are being handled through the Trade and Industry Tours Association, New York, which organizes study tours for German, Austrian and Swiss delegations when sponsored by leading organizations of those countries.

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december, 1957
vol. 32, no. 6

modern castings

in this issue

COVER PHOTO: Setting cores for diesel engine block at FIAT foundry, Turin, Italy

regular departments

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1958 MODEL CHANGES

The January issue of MODERN CASTINGS will introduce the new look of two additional departments to better serve the expanding needs of its readers and the American Foundrymen's Society. One of these new departments will be devoted exclusively to local and national activities of the AFS and its members. The second feature supplement will make available to MODERN CASTINGS' readers most of the technical papers scheduled for presentation at the annual Castings Congress.

■ The AFS News Department in MODERN CASTINGS will become the principal medium for communication of AFS activities—at both the local and national level. All members will be kept completely informed of what is happening in every Chapter as well as the latest developments in national programs such as the Training & Research Institute; Castings Congress & Show; Apprentice Contest; Foundry Instructors Seminar; Safety, Hygiene & Air Pollution Control; Technical Committees; Books; and Regional Conferences. The broadened scope and importance of this activity is emphasized by the appointment of George A. Mott to the position of AFS News Editor. Mr. Mott will dedicate his efforts to keeping AFS members completely and currently informed of all activities within the Society.

■ Of no less importance, the new monthly Bonus Section will for the first time make it possible for over 19,000 men of the castings industry to be able to read most of the technical papers prepared for the annual Castings Congress. A selected number of these technical papers will appear in each issue as a MODERN CASTINGS Bonus Section. By making this information available to a maximum number of readers well in advance of the annual Castings Congress, more time will be available for preparation of written discussions. Broad dissemination of this top-rated casting technology should stimulate higher attendance at the technical sessions and more discussion, both written and oral. Heretofore distribution of this valuable material was limited to those few thousand who requested reprints or purchased the annual volume of Transactions.

Papers received too late for publication prior to the Congress will be considered for inclusion in the Technical Bonus Sections appearing in subsequent issues. All Congress papers and their discussions will be published, according to past custom, in the annual bound volume of AFS Transactions.

The constant challenge to better serve our readers has been a subtle process that has stimulated the introduction of such new MODERN CASTINGS' features as: Questions & Answers, Dietrich's Corner, the SHAPe of Things, Patent Review, Committees in Action, Foundry Facts Notebook, and On the Management Side. The addition of these two new departments will be another forward step in continuing to make MODERN CASTINGS—*"The Foundrymen's Own Magazine."*

Gray Iron Annual Meeting Features Costs and Sales

Cost reduction, national mobilization, and sales training highlighted the 29th Annual Meeting of the Gray Iron Founders' Society, Inc., October 9 to 11 at the Drake Hotel, Chicago. G.I.F.S. President, J. Scott Parrish, Jr., Richmond Foundry and Manufacturing Co., Richmond, Va., presided.

Parrish was re-elected president of the G.I.F.S. for the coming year. Other officers re-elected at the meeting are A. M. Nutter, E. L. LeBaron Fooundry Co., Brockton, Mass., Vice-President; A. H. Renfrow, Renfrom Foundry, Los Angeles, Secretary; and C. R. Garland, W. O. Larson Foundry Co., Ohio, Treasurer.

New directors elected for three year terms are: W. G. Butler, Golden Foundry Co. Inc., Columbus, Ind.; R. Mayo Crawford, Turner & Seymour Manufacturing Co., Torrington, Conn.; J. Douglas James, Urick Foundry Co., Erie, Pa.; and R. W. Wilder, Elkhart Foundry and Machine Co., Elkhart, Ind.

D. H. Workman was reappointed Executive Vice-President.

Presentation of the new officers and directors occurred at the luncheon closing the meeting. Another feature of the luncheon was the presentation of citations and awards for 1957, highlighted by the announcement of the G.I.F.S.'s highest award, the Gold Medal, awarded to Hermann P. Good, Textile Machine Works, Reading, Pa.

Serving in official capacity as a member of the GIFS board of directors for eight years, and as president from 1948 to 1950, Mr. Good contributed to the preparation of a *Gray Iron Hand-Book* as chairman of the committee which announced completion of the hand-book at the meeting.

Other G.I.F.S. members honored for service to the industry were C. H. Meminger, Posey Iron Works, Inc., Lancaster, Pa.; and George L. Nimocks, Dayton Foundry, Hollydale, Calif.

First prize of $500. in the Redesign Contest went to Harold R. Warsmith, Jeffrey Manufacturing Co., Columbus, Ohio. The contest is sponsored in order to give recognition to designers, engineers, etc., who have contributed to the redesign on conversion of competitive materials to gray iron castings.

Mr. Warsmith was awarded the top prize for his redesign of a chain link from a steel weldment to ductile iron.

Second prize of $100 was awarded

Circle No. 124, Page 7-8

to E. S. Frens, General Electric Co., Schenectady, N.Y., for the redesign of a compressor discharge casing from weldments to gray iron.

Five prizes of $50 each were divided as follows: Charles Buran, National Can Corp., Santa Clara, Calif.; John S. Hanson and Fred J. Zeglen, Detroit Diesel Engine Div., General Motors Corp., Detroit; William D. Rowe, Sparton Aircraft Co., Tulsa, Okla.; R. B. Kennicut, Jr., I. Case Co., Bettendorf, Iowa; and Jack Bendor, Printing Industries Equipment, Inc., New York.

Direct Mail

Following registration on Oct. 10, reports of the standing committees of G.I.F.S. were presented. The Advertising Committee reported that through direct mail advertising in promotion of the Redesign Contest, design engineers were asked to submit new applications for gray iron as well as redesigns.

In this manner the committee intended to call the engineer's attention to gray iron as a material whether or not he entered the contest. The response to the new approach was ten times that of any previous one, in the past, no more than ten entries were received. This year approximately 100 candidates submitted entries.

After this morning business session, a sales promotional film, *The Big Difference,* produced by Superior Steel & Malleable Castings Co., Benton Harbor, Mich., was shown.

At the industry luncheon, J. Lewis Powell, Office of Assistant Secretary of Defense, offered his views on the effect of a national emergency on the industry in a speech titled, *What Mobilization Would Mean to You.*

An afternoon informal discussion on gray iron terms and conditions of sale rounded out the major business sessions of the day. Peter E. Rentschler, Hamilton Foundry & Machine Co., and Curtis C. Williams, Jr., G.I.F.S. Legal Counsel, Jones, Day, Cockley & Reavis, moderated the discussion.

The first speaker of October 11 was Harold Brown, Hunt-Spiller Corp., Boston. Mr. Brown spoke on *Developing Sales and Salesmen. Engineering Cost Reductions* was the subject of a talk given by Chester V. Nass, Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago.

The final speaker of the day was Roy A. Foulke, Dun & Bradstreet, Inc., New York. Mr. Foulke spoke on his company's relationship to the industry, in *Ratios Can Get You*

Circle No. 125, Page 7-8

Build an idea file for plant improvements. The post-free cards on page 7-8 will bring more information on these new . . .

products and processes

CORE PASTES . . . in plastic squeeze applicator eliminates filling of putty

tubes. Request free sample by circling No. 1 on Reader Service Card. *Frederic B. Stevens, Inc.*

WELDING PROCESS . . . cuts cost and speeds repair of mild steel castings. Magnetic-flux, gas-shield arc-welding, continuous-feed process is said to produce high-quality welds faster and cheaper than covered electrodes. Deposition rate on down-hand welding is 50-100 per cent greater and 200-300 per cent greater on vertical and overhead positions. May be used in all positions with welds having uniform penetration. *Linde Co., Div. Union Carbide Corp.*

For Manufacturer's Information Circle No. 2, Page 7-8

PORTABLE HEATER . . . burning kerosene, diesel or fuel oil, delivers 90,000 Btu/hr. Operates for only pen-

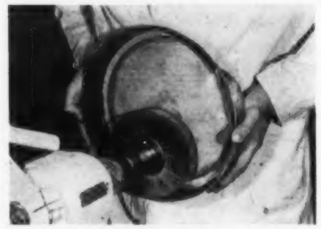
nies per hour. Flame filter insures complete safety from noxious gases. *Silent Glow Oil Burner Corp.*

For Manufacturer's Information Circle No. 3, Page 7-8

DIRECT READING SPECTROMETER . . . gives 80-second analysis of 10 elements in Pittsburgh casting and forging plant. Elapsed time of 8 min between taking of sample and reporting analysis allows determinations before heat is tapped. *Allegheny Ludlum Steel Corp.*

For Manufacturer's Information Circle No. 4, Page 7-8

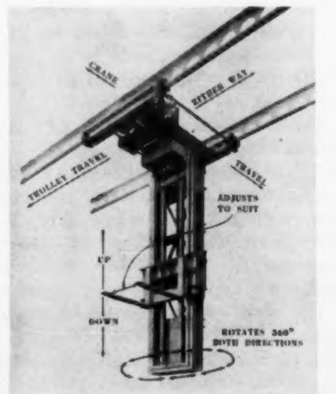
POLISHING AND GRINDING WHEELS . . . provide faster wheel changing and flush sanding through recessed-type flanges bonded to the core. Flanges said to provide extra



wheel strength, allow the finishing of right angles and permit closer ganging of wheels to obtain a wider abrasive surface. Available in 6-10 in. diameter wheels and widths 1½-in. up. *Minnesota Mining & Mfg. Co.*

For Manufacturer's Information Circle No. 5, Page 7-8

OVERHEAD FORK LIFT . . . travels on monorail system. Allows more



efficient use of space through higher stacking and narrower aisles. Three motors allow fork lift to travel for-

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■ **Details on these products and processes are available to MODERN CASTINGS readers. See pages 7-8.**

ward and backward, up and down, and to turn through full circle. No floor wear, improved vision for operator, and low maintenance are a few of the plus features. *Cleveland Tramrail Div., Cleveland Crane & Engineering Co.*

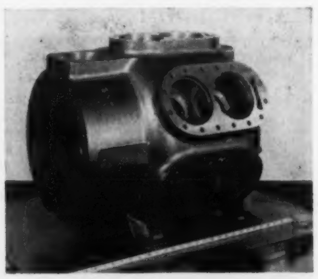
For Manufacturer's Information Circle No. 6, Page 7-8

CASTINGS HANDLING BOX . . . made of high strength steel. Withstands hot castings and rough han-

dling. Unit measures 26x28x53 in., has 16-in. legs for fork lift handling. Sides and bottom are corrugated. Boxes may be stacked. *Pressed Steel Div., Republic Steel Corp.*

For Manufacturer's Information Circle No. 7, Page 7-8

BARREL FINISHING . . . cleans 285-lb compressor casting reportedly for less than competitive methods. Leaves gasket surfaces burr-free with low microinch finish. Custom-designed fixture holds any intricate part dur-



ing cleaning. Will process any part for you and submit technical report without obligation. *Almco Div., Queen Stove Works, Inc.*

For Manufacturer's Information Circle No. 8, Page 7-8

MONORAIL SYSTEMS . . . used in foundries for drawing patterns, unloading materials, making up charges, charging furnaces, placing cores in oven, sand handling, closing molds, pouring off, distributing hot metal, and delivering castings. Trambeam is

a moving monorail supported on each end so that it can be positioned anywhere in the foundry bay. Converts "dead" overhead space into a "live profit zone." Available in 1200-20,000-lb capacities. *Whiting Corp.*

For Manufacturer's Information Circle No. 9, Page 7-8

BUCKET ELEVATOR . . . with vertical slide in boot section minimizes loading, jamming, and plugging. Heat-

resisting belts allow cool running with hot materials. Available in three bucket sizes and capacities from 4800 lb/hr of 50 lb/cu ft material to 82,800 lb/hr of 140 lb/cu ft material. Discharge heights range from 35 to 80 ft. *Carpco Mfg., Inc.*

For Manufacturer's Information Circle No. 10, Page 7-8

HARDNESS TESTERS . . . make both regular and superficial tests, available in four models ranging in vertical capacities from 4 to 16 in. *Torsion Balance Co.*

For Manufacturer's Information Circle No. 11, Page 7-8

CLEANING ROOM . . . finishes 1500-lb steam dome in 10 min compared to 90 min with hand labor. Ten min

includes 3 min for cleaning and 7 min for preparation. *Wheelabrator Corp.*

For Manufacturer's Information Circle No. 12, Page 7-8

SHELL MOLDING RELEASE AGENT . . . a non-flammable silicone emulsion, resists excessive film build up and repeated freezing and

■ **Details on these products and processes are available to MODERN CASTINGS readers. See pages 7-8.**

thawing cycles. Can be stored at 125 F without harm. Shipped as concentrate; dilute with water in your plant. Sludge formation on pattern surface practically eliminated. *Silicones Div., Union Carbide Corp.*

For Manufacturer's Information Circle No. 13, Page 7-8

CHEMICAL JOINING . . . of nonferrous metals made by permanent chemical bond through ion exchange.

Said to reduce present joining costs 50-300 per cent. May be used in manual or mechanized operations. *Intertectics, Inc.*

For Manufacturer's Information Circle No. 14, Page 7-8

ELECTRIC VIBRATOR . . . said to have low maintenance cost and increased life since rotor is only moving part. Unit weighs 84 lb. For use on bins, chutes, and hoppers for dry or viscous bulk materials. *Cleveland Vibrator Co.*

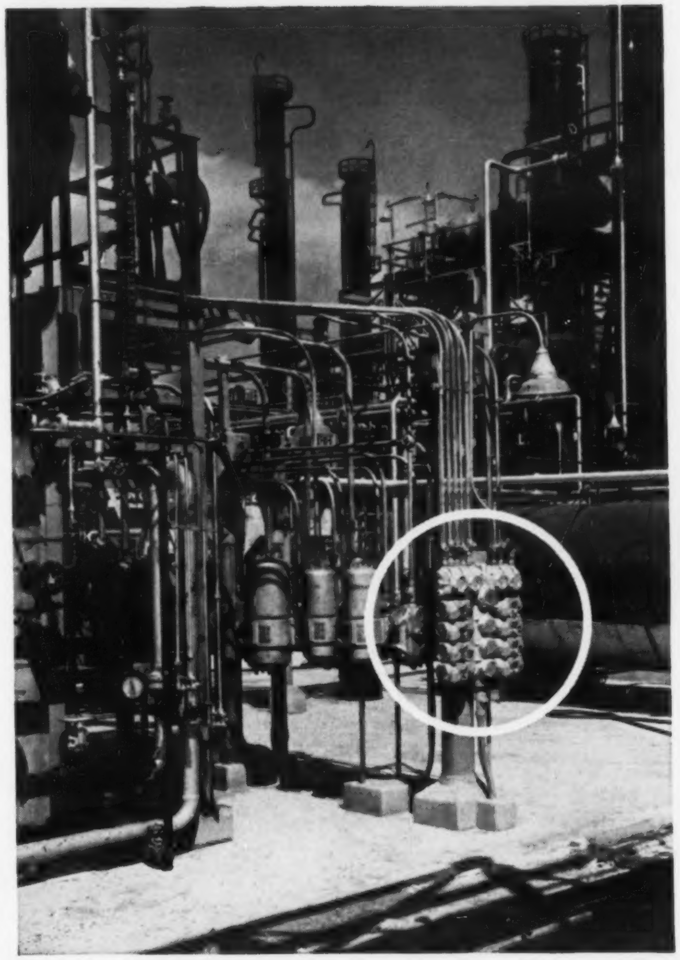
For Manufacturer's Information Circle No. 15, Page 7-8

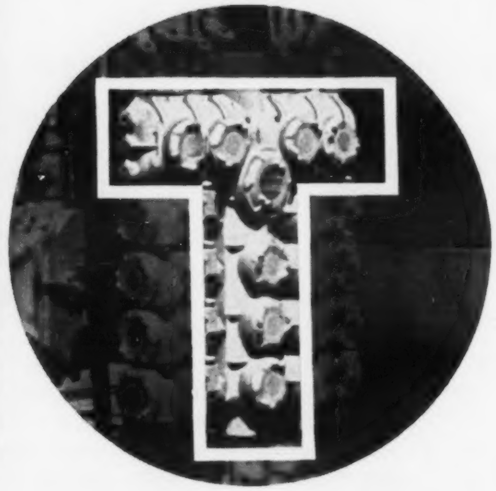
BAND SAW . . . cuts cost by freeing operator who clamps work and makes settings. Selector chart aids you in choosing correct tooth-per-in. blade

and speeds for various stock. Wide range of variable blade speeds and other setting made from centrally-located panel. Constant blade feed. *American Machine & Foundry Co.*

For Manufacturer's Information Circle No. 16, Page 7-8

HYDRAULIC PRESSES . . . for trimming die castings are said to increase





operations 50 per cent. Down stroke, return, and stopping of ram are all done hydraulically. Existing dies can be used since down stroke control feature permits adjustment. By stopping reverse stroke at any desired point, the cycle can be shortened. Steady pressure allows casting to center itself properly in die for more uniform cutting. Available in 10-50 ton capacities. Technical article describes uses in New York casting company. *Hannifin Corp.*

For Manufacturer's Information
Circle No. 17, Page 7-8

PROJECTOR . . . for measuring or comparing objects by means of magnified shadow allowing rapid inspection of parts. Inclined 14 in. screen avail-

able in three styles. Six standard lens magnify from 10 to 100X, are changed by slipping into vertical sockets. *George Scherr Co.*

For Manufacturer's Information
Circle No. 18, Page 7-8

TAP EXTENSION . . . speeds production by permitting fast tapping of remote blind holes. Eliminates need

for pulley taps and designed so dull or broken taps can be changed by hand. Available in standard 9-in lengths or special order. *Ritmar Corp.*

For Manufacturer's Information
Circle No. 19, Page 7-8

INDUSTRIAL UTILITY BUILDING . . . all steel, costs 70 cents per sq ft (F.O.B. factory) under erect-it-yourself plan. Self-levelling structural features use adjustable steel columns and girts for easy plumb and squaring. A 36x72 ft building may be erected by unskilled labor in 180-200

■ Details on these products and processes are available to MODERN CASTINGS readers. See pages 7-8.

man-hours. All framing connections made through factory-drilled holes by bolting. Height of columns adjustable after placing in ground. *Stran-Steel Corp., Div. National Steel Corp.*

For Manufacturer's Information Circle No. 20, Page 7-8

PROTECTIVE COATING . . . for metallic surfaces prevents oxidation and corrosion from exposure to air, water, or elements. Ability to conform to difficult shapes and to withstand shipping makes it suited for protection of castings. Applied by spraying, dipping, wiping, or brushing. Quick drying, it protects 6 to 12 months. Removed by spray-washing or standard hydrocarbon solvents. *Navan Co., Div., North American Aviation, Inc.*

For Manufacturer's Information Circle No. 21, Page 7-8

RADIATION PYROMETER . . . gives 98 per cent of full reading in two seconds. Special unit for moving objects gives reading in 0.6 sec. Measures radiant energy given off by hot objects. Can be used at greater distance from hot objects than possible with other types. Models cover temperatures 1000 to 3300 F. Accessory equipment adapts to furnace and salt bath installations. *Instrument Div., Robertshaw-Fulton Controls Co.*

For Manufacturer's Information Circle No. 22, Page 7-8

ELECTRIC HOIST . . . available in single or two-speed control, has capacities from 1000 to 10,000 lb. Lifting speeds vary from 13 to 60 ft per min. Balance is provided with motor on one side, drum on the other, and load centered below runway beam. *Chisholm-Moore Hoist Div., Columbus McKinnon Chain Corp.*

For Manufacturer's Information Circle No. 23, Page 7-8

OVERHEAD MONORAIL SYSTEMS . . . for manual or power operation are designed as integrated units, including track splices curves, clamps, switches, stops, brackets, and turntables. Auxiliary equipment includes buckets, grabs, racks, slings, scales, dipping sections, and tower type lift sections. *Morris, Wheeler & Co.*

For Manufacturer's Information Circle No. 24, Page 7-8

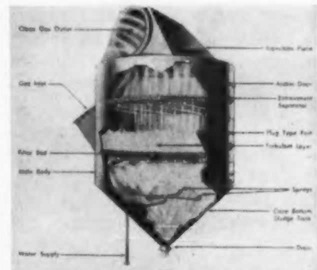
STEAM ATMOSPHERE . . . heat treating is said to seal microscopic porosity, improve corrosion and wear resistance of gray iron castings. Gives non-ferrous castings a scale-free fin-

Circle No. 131, Page 7-8

ish for bright dip or use as-is. Furnace is brought to 700 F with air atmosphere, held 30 min, and steam injected to purge air from work chamber. Load is heated to soak temperature, held for specified time with steam flowing through furnace. At end of soak, parts are air-cooled or oil-quenched. *Leeds & Northrup Co.*

For Manufacturer's Information Circle No. 25, Page 7-8

DUST COLLECTOR . . . lowers maintenance cost since unit has no moving parts within collection area and interior is continually flushed. Scrubber type employed where more than



one collector is used and common settling tank or sludge basin is employed. Glass spheres used in separation. *National Dust Collector Corp.*

For Manufacturer's Information Circle No. 26, Page 7-8

SIEVE SHAKER . . . for testing, gradation of sand and other granular or powdery materials. Has continual shaking and redistribution of materials to develop easy gravity flow of materials from sieve. *Soiltest, Inc.*

For Manufacturer's Information Circle No. 27, Page 7-8

GAGE BLOCK . . . life extended by use of maintenance kit containing equipment needed to keep blocks

clean and free from rust and burrs even when in constant use. Literature explains use of kit. *DoAll Co.*

For Manufacturer's Information Circle No. 28, Page 7-8

POWER BELT CONVEYORS . . . available in two models, one handles horizontal loads up to 75 lb per ft

HERE'S WHAT A NEW LOW COST CB10C FLEXIBLO CAN DO FOR YOU

SAVE on initial cost
Not only does the new Patented CB10C cost less than other machines of its capacity, but it handles all types of core boxes, open, horizontally split, or vertically split . . . can replace several single-purpose machines. High capacity side clamp unit is installed in seconds.

SAVE on operating cost
Actually uses less air per cycle. Automatic sequence control and push-button operation means faster operation too.

SAVE on core box cost
The new CB10C handles wood or metal core boxes. Normally the same unvented wooden core boxes used for manual coremaking can be used on the Flexiblo without modification.

SAVE on coremaking labor
One man and a CB10C can surpass the production of several manual coremakers even working with unvented wooden boxes.

SAVE on machine maintenance
This Flexiblo's clean rugged construction and simple all pneumatic circuit means far less maintenance . . . less costly downtime. Single air line is only connection to the machine.

SAVE on box maintenance
The Flexiblo's new air-on-oil, super smooth clamping action is far easier on boxes . . . pounding or blow-by are eliminated. The Flexiblo's exclusive blow action cuts box wear too . . . even when wooden boxes are used.

ONE OF THE NEW FLEXIBLOS guaranteed to blow any core box, wood or metal, that can be blown on any machine, using the same core sand and to blow cores harder, faster and with less wear on core box face or joint and cavity.

PROGRESSIVE FOUNDRIES LOOK TO
BEARDSLEY & PIPER
FOREMOST DEVELOPER OF FOUNDRY MACHINERY

MEMBER FEMA

Write now for full information — BEARDSLEY & PIPER
Division Pettibone Mulliken Corp., 2424 N. Cicero Avenue, Chicago 39, Illinois

■ Details on these products and processes are available to MODERN CASTINGS readers. See pages 7-8.

and inclined loads up to 50 lb per ft. Other handles loads up to 100 lb per ft horizontally and 50 lb per ft or more on incline. Come in standard bed lengths from 5 to 100 ft. Purchaser can assemble with simple hand tools. *A. B. Farquhar Div., Oliver Corp.*

For Manufacturer's Information Circle No. 29, Page 7-8

SELECTOR TRUCK . . . for faster warehousing or picking operations used with tractor-trailer system, in-

floor dragline, or manual operation, 2500-lb capacity. Nine steel-bound hardwood deck sizes available. Equipped with 8-in. casters, 10 or 12-in. wheels. *Lewis-Shepard Products.*

For Manufacturer's Information Circle No. 30, Page 7-8

CASTING COUNTER . . . tallies pieces from 8 oz to 25 lb within clearances 10x15 in. Top may be raised for hand counting larger cast-

ings. Unit will not double-count. Models available for counting small castings 2-5 pieces at a time. *Hartley Controls Corp.*

For Manufacturer's Information Circle No. 31, Page 7-8

MONORAIL SYSTEMS . . . for foundries are used in continuous pouring, molding, and cleaning operations. Variety of track and switch arrangements give flexibility. Rubber wheel

Circle No. 133, Page 7-8

drive is said to increase traction-area. Track is formed of twin sections bolted together with one-piece hangers providing additional support where needed. *American Monorail Co.*

For Manufacturer's Information Circle No. 32, Page 7-8

OVER-RIDING CRANES . . . in capacities from 1 to 10 tons and spans up to 50 ft, are hand-pushed, hand-chain, or motor-driven. Sold as assembled unit or individual components. *Becker Crane & Conveyor Co.*

For Manufacturer's Information Circle No. 33, Page 7-8

ELECTRIC HOIST . . . lifts from 7 to 50 ft per min using standard voltage current. Compact design provides close head room. Loads protected by solenoid motor brake and heavy

duty friction type—both automatic. Brake action permits accurate load positioning. Available in 1/4-2 ton capacities. *David Round & Son.*

For Manufacturer's Information Circle No. 34, Page 7-8

HIGH-LOW SPEED HOISTS . . . used by foundries for precise control drawing patterns. Permits rapid lifting or slow, steady placement. Motor said to deliver constant speed. *Hoist & Crane Div., Robbins & Myers, Inc.*

For Manufacturer's Information Circle No. 35, Page 7-8

LIGHTWEIGHT HOIST . . . available in 250-2000-lb capacities, furnished without trolley, with push type trolley or top hook, and with wheel type collectors or flexible tag line. Can plug into power receptacle. *Shepard Niles Crane & Hoist Corp.*

For Manufacturer's Information Circle No. 36, Page 7-8

DRY MATERIALS VALVE . . . with metal-to-metal seat is said to eliminate 95 per cent of trouble caused by sticking and sifting. Useful in foundry blenders, feeders, and conveyor systems. *General Machine Co. of N. J.*

For Manufacturer's Information Circle No. 37, Page 7-8

CONVEYOR BELT . . . for high temperature foundry applications, such as

Circle No. 135, Page 7-8

■ Details on these products and processes are available to MODERN CASTINGS readers. See pages 7-8.

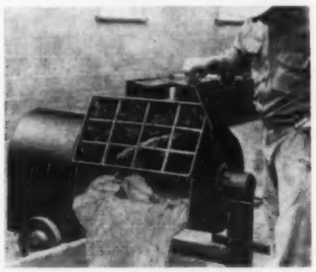
shakeout, withstands sustained temperature of 400 F and a peak load of over 700 F for short periods of time. Belt contains new HTB type of butyl rubber said to have improved properties. Philadelphia foundry using it to carry hot sand and hot scrap metal. *United States Rubber Co.*

For Manufacturer's Information Circle No. 38, Page 7-8

NON-FERROUS BRINELL TESTER . . . cuts inspection time on wide variety casting sizes through rapid setting of test head which may be removed for use on parts over 10-in. high. Portable unit can be used in any position. *King Tester Corp.*

For Manufacturer's Information Circle No. 39, Page 7-8

CO_2 SAND MIXER . . . said to cut mixing time in half. Works equally well with all core binders; will not heat, crush or ball sand. Portable or



fixed, unit is easily cleaned. Core sand mixer is one of lowest priced in industry, according to the manufacturer. Model illustrated has 2 cu ft capacity, mixing over 100 lb core sand per load. *U. S. Forge & Foundry Co.*

For Manufacturer's Information Circle No. 40, Page 7-8

DIRECT READING SPECTROMETER . . . can analyze six elements within 57 seconds. Gives direct readings without integration. Suited for practically all cast-metal alloy systems. Can be installed and ready for operation within two days. *Intercontinental Electronics Corp.*

For Manufacturer's Information Circle No. 41, Page 7-8

INSULATING FIRE BRICK . . . cut fuel bills up to 40 per cent in Cleveland plant. Brick withstands temperatures to 3000 F, may be used as exposed refractory lining or back-up insulation. It has an extremely low heat-storage capacity so fuel is saved during the heat-up. *Johns-Manville Corp.*

For Manufacturer's Information Circle No. 42, Page 7-8

for the asking

Steel casting brochure lists three basic requirements for successful product design. Charts tell how you can take advantage of functional requirements, favorable cost, and low maintenance. *Steel Founders' Society of America.*

Circle No. 61, Page 7-8

Machining gray and nodular iron, 22-p booklet, covers machining properties of cast iron, cutting tools and machine tool requirements, economics of cutting speed versus tool wear, tool change and repair, and idle machine time. Performance data supplied on various types of grinders. *The Hamilton Foundry & Machine Co.*

Circle No. 62, Page 7-8

Deoxidizing and degassing additive for gray, white, malleable, or high nickel cast irons is described in leaflet covering precautions, use, and advantages. *Foundry Services, Inc.*

Circle No. 63, Page 7-8

Air setting binders, technical article, lists the advantages and disadvantages, equipment, temperature, decreased waiting time, core washing and baking, patching, and slicking. *Archer-Daniels-Midland Co.*

Circle No. 64, Page 7-8

Portable heating equipment catalog giving information on blower-type heaters, salamanders, infra-red heaters, and accessories for operation with LP-gas. *Insto-Gas Corp.*

Circle No. 65, Page 7-8

Catalytic exhaust purifiers for gasoline, LP-gas, and diesel engines described in brochure. Points out dangers of poisonous exhaust fumes from trucks and how to reduce them in your plant. *Oxy-Catalyst, Inc.*

Circle No. 66, Page 7-8

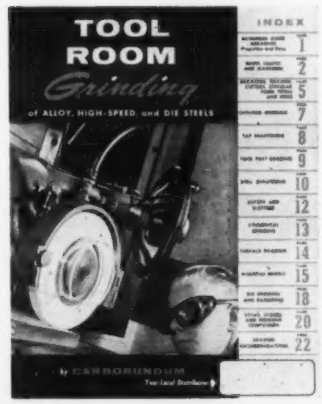
Enclosed-tip thermocouples are illustrated in descriptive 8-p catalog. Gives prices of all the replacement parts for stationary and portable units. *L. H. Marshall Co.*

Circle No. 67, Page 7-8

Lithium uses, present and future, summarized in monthly newsletter. Includes a review of new developments as well as current articles appearing in trade publications.

Circle number 68 on Reader Service Card p. 7-8 if you would like to receive free monthly newsletter. *American Lithium Institute, Inc.*

Tool room grinding of alloy, high-speed, and die-steels brochure, 24 pp, covers 22 areas in bonded abra-



sives field is designed to be a single source book on grinding for tool room men. Illustrative pictures and quick reference charts. *Carborundum Co.*

Circle No. 69, Page 7-8

Electrical insulation selector chart is ready-reference for users of electrical insulation materials. Over 30 types of insulating materials fully described.

To receive your copy of chart, circle number 70 on p. 7-8 Reader Service Card. *Sun Chemical Corp.*

Molybdenum use in improving properties of cast iron discussed in 6-p brochure. Covers resistance to growth, heat checking, scaling, and deformation under load. Includes reprint of recent technical article. *Climax Molybdenum Co.*

Circle No. 71, Page 7-8

Hand-operated blast cleaning machines bulletin, 28 pp, has guides for selecting correct hose machine,

supplemented with table showing how to match nozzle size with required abrasive size. Complete engineered drawings show how each model operates. *Pangborn Corp.*
Circle No. 72, Page 7-8

CO_2 shell molding development reviewed. New process and advantages of being non-inflamable and non-gas forming is described. *Philadelphia Quartz Co.*
Circle No. 73, Page 7-8

Air blow guns catalog, 12 pp, describes and illustrates types of air blow and spray guns for mold spraying, cleaning, and other applications; safety chip guns; air spray nozzles; oil mist lubricator; swivel connector; air hose couplings; and other industrial air specialties. *C. A. Claflin Co.*
Circle No. 74, Page 7-8

Sand conditioning unit featured in 4-p bulletin telling advantages of aeration, blending and mixing, plus magnetic separation. Available in portable and stationary models that will economically mechanize small foundries. *Royer Foundry & Machine Co.*
Circle No. 75, Page 7-8

Book of Matches, safety publication, points up seriousness of fires in jobs and to industrial property; tells what to do in event of fire. *National Safety Council.*
Circle No. 76, Page 7-8

Induction melting, high frequency motor-generator equipment, featured in 4-p bulletin describing 960, 3000 and 10,000-cycle high-frequency units. Available in 30 to 1250 kw sizes applicable for efficient low-cost melting, brazing, annealing. *Allis-Chalmers Mfg. Co.*
Circle No. 77, Page 7-8

Investment-cast-metals chart, offers reference material on ferrous base and non-ferrous alloys. Gives mechanical properties for metal—in as—cast or annealed state and in hardened condition. *Alloy Precision Casting Co.*
Circle No. 78, Page 7-8

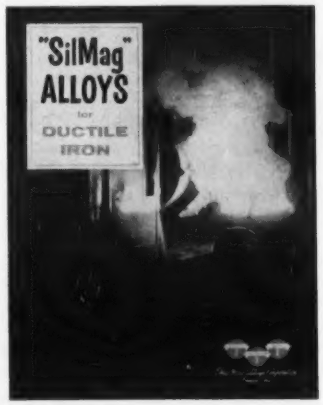
Special refractories for shapes, gunning, and slap troweling applications at service temperatures up to 3000 F. Illustrated in 12-p booklet. *Johns-Manville Sales Corp.*
Circle No. 79, Page 7-8

Cleaning problems 34-p. brochure, covers case histories, photographs, schematic drawings on airless blast cleaning, wet blast cleaning employed in specific applications. *Wheelabrator Corp.*
Circle No. 80, Page 7-8

Dielectric core oven catalog tells how to cure cores in seconds with radio

frequency power. Includes engineering data and dimensions on 14 standard models with capacities ranging from 30 to 200 kw, complete construction specifications, design and advantages. *Foundry Equipment Co.*
Circle No. 81, Page 7-8

Ductile iron catalog presents data on Silmag alloys for desulphurizing, nodularizing and inoculating. Compares



cost with various magnesium additives. *Ohio Ferro-Alloys Corp.*
Circle No. 82, Page 7-8

Plastic refractories for building monolithic, uniform linings covered in 6-p brochure. Advantages over brick construction and typical applications covered. *North American Refractories Co.*
Circle No. 83, Page 7-8

Molten metal handling equipment for all metals featured in 72-p publication containing photographs, dimension sheets and other data. *Industrial Equipment Co.*
Circle No. 84, Page 7-8

Pattern draw vibrators 4-p folder shows exploded view of vibrator. Designed for economical production of quality molds. Also includes specifications, application and description of blow gun, operating valves, and hose connections. *Osborn Mfg. Co.*
Circle No. 85, Page 7-8

Safety cleaner bulletin describes safe replacement for carbon tetrachloride. Compares maximum allowable vapor concentrations of the commonly used chlorinated solvents and this new cleaner. *Harco Chemical Co.*
Circle No. 86, Page 7-8

Crucible tool steels for the die casting industry described in 16-p catalog of technical data. *Crucible Steel Co. of America.*
Circle No. 87, Page 7-8

Gravity roller conveyor systems are shown in photographs illustrating various types and combinations of this

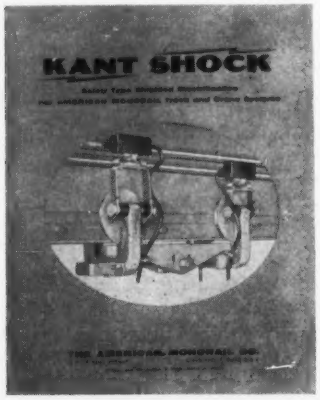
equipment. Included are blueprints and descriptions of straight roller sections, curves, switches. *The Alvey-Ferguson Co.*
Circle No. 88, Page 7-8

Stationary air compressors covered in literature showing size range from ½ to 100 hp including both single and two stage units. Specifications, and drawings used for pocket-size book. *LeRoi Div., Westinghouse Air Brake Co.*
Circle No. 89, Page 7-8

Machining manual, 22-pp, contains guide for machine feeds and speed, quantity-weight slide rule calculator, and other basic information. *Kaiser Aluminum & Chemical Sales, Inc.*
Circle No. 90, Page 7-8

Welders' vest pocket guide, 60-pp, describes and illustrates complete information on metals and electrodes, four essentials of proper welding procedures, types of joints, welding positions, explanation of A.W.S. classification numbers, and comparative index of electrodes. *Hobart Bros. Co.*
Circle No. 91, Page 7-8

Shielded electrification for overhead handling systems covered in bulletin. Unique design prevents electrical ac-



cidents and permits splicing of bars anywhere in the system. *The American Monorail Co.*
Circle No. 92, Page 7-8

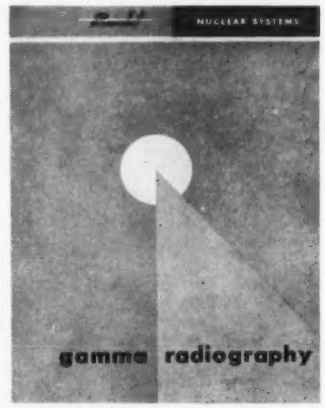
Brass and bronze fluxes cut melting costs, reduce rejections and scrap caused by dirty metal. Complete details are in publication. *Niagara Falls Smelting & Refining Div., Continental Copper & Steel Industries, Inc.*
Circle No. 93, Page 7-8

Abrasive chips and media for precision mass production barrel finishing. New triangular abrasive chip design illustrated. *Macklin Co.*
Circle No. 94, Page 7-8

Materials handling equipment notebook contains seven case studies of

how manufacturers solved production problems with modern materials handling equipment. Each history fully illustrated with photographs taken in plants. *Lewis-Shepard Products, Inc.*
Circle No. 95, Page 7-8

Gamma radiography of castings detailed in 18-p manual covering cost, versatility, safety, portability, mainte-



nance, and exposure time. *Nuclear Systems, Div. Budd Co.*
Circle No. 96, Page 7-8

Monorail applications in foundries are included in 74-p equipment catalog. Photos show applications in such operations as molding and pouring lines. *Jeffrey Mfg. Co.*
Circle No. 97, Page 7-8

Electric hoists and trolleys for overhead handling discussed in 8-p brochure. Increases productivity and cuts costs. *Chisholm-Moore Hoist Div., Columbus McKinnon Chain Corp.*
Circle No. 98, Page 7-8

Overhead handling systems featured in 12-p booklet describing efficient use of plant space, reduction in handling costs, and fast movement of materials through utilization of overhead space. *Whiting Corp.*
Circle No. 99, Page 7-8

Air research, development, test installations, job opportunities described in an extensive publication recently made available by the U. S. Air Force. *Air Research and Development Command.*
Circle No. 100, Page 7-8

Auxiliary hoists for monorail equipment, general catalog, gives information for all types of hand-operated and electric hoists. *Chester Hoist Div., National Screw & Mfg. Co.*
Circle No. 101, Page 7-8

Electric hoists illustrated and described in bulletin with 63 photographs showing monorail hoists being used for cupola charging, moving hot

metal, and conveying foundry materials. *Shepard Niles Crane & Hoist Corp.*
Circle No. 102, Page 7-8

Utility industrial tractor shown in catalog describing weight distribution, strength, traction, and stability. Versatility indicates many foundry applications. *International Harvester Co.*
Circle No. 103, Page 7-8

How to Move Heavy Loads is a new booklet well-illustrated with professional instructions on the use of roller skids for in-plant movement of loads from 3 to 300 tons. *Stokvis-Edera Co.*
Circle No. 104, Page 7-8

free films

■ **Motion pictures and other visual aids based on foundry processes and supplies are also yours *for the asking*. These films are suggested for formal or informal training groups. The owners of films in this column will send booking request forms to MODERN CASTINGS readers who circle the appropriate number on the Reader Service card (pages 7-8).**

Play it Safe, full color, 22-min running time, dealing with safe grinding practices in the foundry. Produced by Jam Handy Organization. *Peninsular Grinding Wheel Div.*
Circle No. 105, Page 7-8

Films Die Casting—How Else Would You Make It? 16 mm, color, sound, 35-min running time, describes die-casting process and applications. *Rothacker, Inc.*
Circle No. 106, Page 7-8

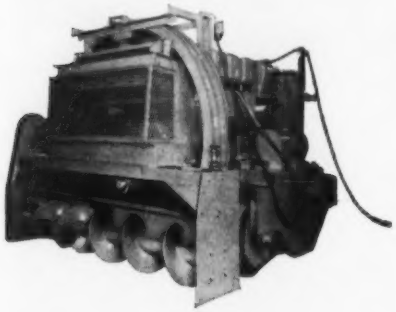
Pay Loads Pay Off, 16 mm, sound, 25-min running time; dramatizes time and motion study; contrasts manual and mechanical handling. *Institute of Visual Training.*
Circle No. 107, Page 7-8

Mechanization from Yard to Ladle, 16 mm, sound, black and white, 12-min film. *Whiting Corp.*
Circle No. 108, Page 7-8

Yours to Command, soundstrip film, 24-min, black and white, depicting mechanical handling hole played in American industry. *Conveyor Equipment Mfg. Assn.*
Circle No. 109, Page 7-8

Men and Molds, 16 mm, sound, black and white, 35-min running time. Shows gray iron foundry operations. *American Foundrymen's Society.*
Circle No. 110, Page 7-8

Romance of Industry, 16 mm, sound, 30-min running time. Portrays discovery, production, fabrication, and applications of abrasive products. *The Carborundum Co.*
Circle No. 111, Page 7-8



the editor's field report

by Jack Schaum

■ Automation in the foundry is more than a theory—it works, and at the rate of 150 V-8 engine blocks per hour for Pontiac Motor Div., GMC. Two years of production experience have proven the feasibility of automating the molding, casting, and shakeout of cylinder blocks in their foundry. The robots of automation and the muscles of mechanization are being rehabilitated daily by an alert preventive maintenance crew of four men—a pipefitter, electrician, millwright, and repairman. This is the crew that foundries are depending on more than ever before to maintain a smooth flow of casting production. Pontiac credits a good maintenance program for a large measure of its success with the automated mechanized foundry.

■ Claimed to be the largest cupola in the United States, a 132-in. (inside diameter) monster is being planned for the Chicago area. Just to keep this department accurate let us know if you are aware of any cupola larger than this record-breaker.

■ Vacuum stream degassing of steel has been practiced for some time in Germany. Last month two large steel companies announced operating installations for ingot production. At least one foundry that we know of is getting into the act. On the way to the New England Regional Foundry Conference a day was spent in Schenectady at the new General Electric Research and Development Foundry. They have just finished building a vacuum stream degasser to treat 2-ton experimental heats of steel. A steam-ejector pump reduces the pressure of the chamber to 200 microns in 3 minutes and degasses 2 tons of steel in 1 minute. GE forsees important applications for this H_2-free steel in cast steam turbine parts. We would be interested in hearing of any other foundries which have already or are contemplating similar installations.

■ The versatility of spectrographic analysis equipment has been extended by the development of a vacuum spectrometer attachment that will rapidly determine the elements C, S, O, P, N, and H.

■ In a recent conversation with Ed Boyle (retired Master Molder of Puget Sound Naval Shipyard) he said that cast-iron foundrymen were having success with riser sleeves made from expanded perlite. Regular core sand binders are mixed with the perlite. Sleeves with 1-in. walls are rammed and baked. Placed in the riser cavity, they improve the feeding efficiency of cast iron risers. Non-ferrous casters have been using perlite sleeves for some time. Another foundryman is having encouraging success with perlite molds for casting aluminum and magnesium!

Fuller Named to Manage AFS Buyers Directory

■ Curtis G. Fuller has been named manager of the AFS Buyers Directory, a listing of products and services for the metalcasting industry which the American Foundrymen's Society will release in 1959.

Mr. Fuller is the former managing director of Modern Castings and has also served as editorial consultant to the magazine. Before joining Modern Castings, he was editor of the Market Data and Directory Number, *Industrial Marketing* magazine.

In announcing his new post, Mr. Fuller stated that, "In an industry with more than 2500 suppliers there has long been a need for an orderly guide to aid the busy buyer of foundry products and services."

The fundamental aim of the AFS Buyers Directory, he said, will be to organize information so that buyers in every metalcasting plant in North America will have vital purchasing information available for immediate reference.

The goal of AFS, he added, is to "publish a directory that will be at once a guide to products and services and a consolidated catalog of the important suppliers serving the field."

STATEMENT OF OWNERSHIP

Statement required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946 (Title 39, United States Code, Section 233) showing the ownership, management, and circulation of MODERN CASTINGS, published monthly at Pontiac, Ill., for December 1. 1957. 1–The names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, American Foundrymen's Society, Golf & Wolf Roads, Des Plaines, Ill.; Editor, Jack H. Schaum, Golf & Wolf Roads, Des Plaines, Ill.; Managing Editor, Paul R. Foght, Golf & Wolf Roads, Des Plaines, Ill.; Business Manager, Wm. W. Maloney, Golf & Wolf Roads, Des Plaines, Ill. 2–The owner is: American Foundrymen's Society, Golf & Wolf Roads, Des Plaines, Ill. organized not for profit, without stock. Principal officers: President, Harry W. Dietert, Harry W. Dietert Company, Detroit, Mich.; Vice-President, L. H. Durdin, Dixie Bronze Co., Inc., Birmingham, Ala.; Secretary-Treasurer, William W. Maloney, American Foundrymen's Society, Golf & Wolf Roads, Des Plaines, Ill. 3–The known bondholders, mortgages, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: none. 4–Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner. Wm. W. Maloney, Business Manager. Sworn to and subscribed before me this 14th day of November 1957 (Seal). E. R. May, notary public. (My commission expires March 14, 1960.)

Herbert S. Simpson Dies in November

Herbert S. Simpson, 73, past president of AFS and chairman of the board of National Engineering Co., Chicago, died Nov. 3 at his home in Phoenix, Ariz.

He had been seriously ill during the past five years and returned to his Phoenix home in October.

Mr. Simpson was born in Minneapolis and moved to Chicago when a boy. He became engaged in the manufacture of clay working machinery and joined the Hatfield-Penfield Steel Co., Bucyrus, Ohio, progressing to assistant to the president of that company.

H. S. Simpson

In 1917 he associated himself with the National Engineering Co., Chicago, of which organization he was president and subsequently chairman of the board.

A director and past president of AFS, 1941-42, Mr. Simpson gave freely of his time, his abilities and his means to AFS and many other groups. In 1945 he endowed the Peter L. Simpson Gold Medal in honor of his father, who founded National Engineering Co.

His first foundry convention was in Boston in 1917 and he attended every convention thereafter, until illness prevented him in 1957. He was one of the Society's staunchest supporters and one of the most influential men in the industry.

He was a past president of Foundry Equipment Manufacturers Association and was active in civic affairs, serving three terms on the City Council of Evanston, Ill. and as chairman of the city's finance committee.

Surviving are his widow, Isabelle Simpson; son, Bruce L. Simpson, president of National Engineering Co.; daughter, Mrs. Nancy Pelott of Scottsdale, Ariz. He is also survived by six grandchildren.

Herbert and Bruce Simpson are the only father and son who both have served AFS as president.

New Welding Process Cuts Mild Steel Repair Costs

by H. T. Smith / *Mgr. Engineering Service Linde Co., St. Louis*

■ Quality welding of mild steel castings at increased speeds and lower costs has been achieved through the use of a magnetic-flux, gas-shielded arc. The technique, announced in 1957, has doubled the rate of casting repair compared to the coated electrode method.

Operators easily master the technique which has no limitations as to position application. However, lower current densities and greater skill is required in vertical and overhead positions as compared to flat and horizontal welding.

Process Description

Essentially, the components of the magnetic-flux, gas-shielded arc welding are: bare welding wire, magnetizable flux, carbon-dioxide gas, welding current, and a means for controlled feeding of wire, flux, gas, and current.

During welding, flux is carried in a CO_2 gas stream and the wire is fed simultaneously to the torch. At the torch nozzle, the welding current flowing through the wire establishes a magnetic field that attracts the magnetizable flux to the wire. As a result, the wire is flux-covered as it enters the arc.

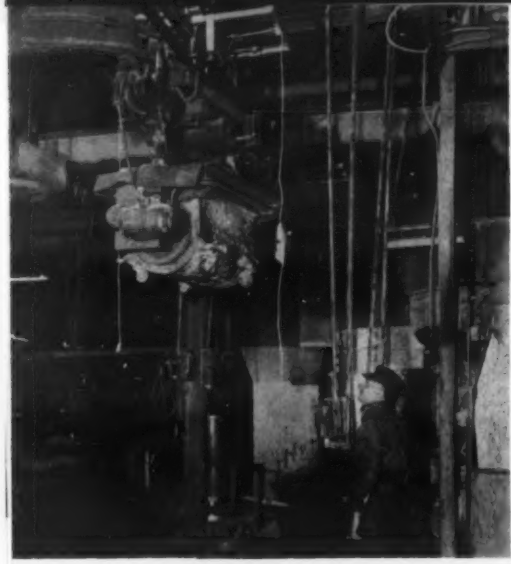
The flux performs three main functions: stabilizes the arc; refines and protects the weld puddle; and controls weld contour and coalescence. The carbon-dioxide gas, in addition to carrying the flux to the torch, provides supplementary shielding, and in combination with the flux gives desirable arc characteristics.

Arc characteristics are somewhat similar to those of conventional covered electrodes, and offer no problems for the average welding operator. In fact, since the wire is fed automatically by the welding machine, manual skill requirements for downhand welding are less than with covered electrode welding.

Mechanized continuous wire feed and high current densities result in high deposition rates. Indications are that in difficult welding positions, vertical and overhead, deposition rate advantages are even greater than in flat and horizontal welding.

Weld Quality

Welds exhibit excellent quality and meet various welding specifications. Excellent penetration is obtained and slag is easily removed. Metal transfer is of a "spray type" and very little spatter is evolved.



Freight car for core room is this dump bucket that hauls 45 tons of core sand daily.

MOVING FOUNDRY MATERIALS-NO.4

MONORAIL CONVEYORS

RAILROAD IN THE RAFTERS

Floor space can be used for profit when foundry materials are moved overhead

RALPH G. WIELAND / *Vice-President*
Forest City Foundries Co.
Cleveland

When expanding production threatens to snarl movements of foundry materials in a massive traffic jam, you may find your problems solved by taking to the air! Overhead monorail conveyors become a railroad-in-the-rafters that speeds the flow of materials while freeing premium aisle space for other activities and installations.

Monorail conveying systems are an integral part of the plant layout at the Maywood Avenue Plant, Forest City Foundries Co., Cleveland, where average daily production has climbed from 70 tons/day to 180 tons/day during a 12-year period.

The mountain of materials required for this added production is now being handled by comparatively fewer men in the same space than required when only producing 70 tons/day.

Monorail systems are used in the Forest City plant for core sand and green core handling, metal distribution, and moving castings to the cleaning department. In these applications the monorail is a permanent and integral part of the plant's production line.

Panel lights signal operator when core station needs sand.

Core Room

In the core room an automatically controlled, self-propelled dump bucket operates on a monorail between the muller and core-blowing machines and core benches. This system services 29 stations in the core rooms and daily distributes 150 loads weighing 600 lb apiece. Two operators load and operate the muller and distribute the sand. Nonproductive sand delivery labor in the core room is virtually eliminated.

When sand is needed at one of the 29 stations, the coremaker presses a button which lights a lamp on a panel board at muller. Responding to this signal, the muller operator prepares the proper sand mix required at the signaling station.

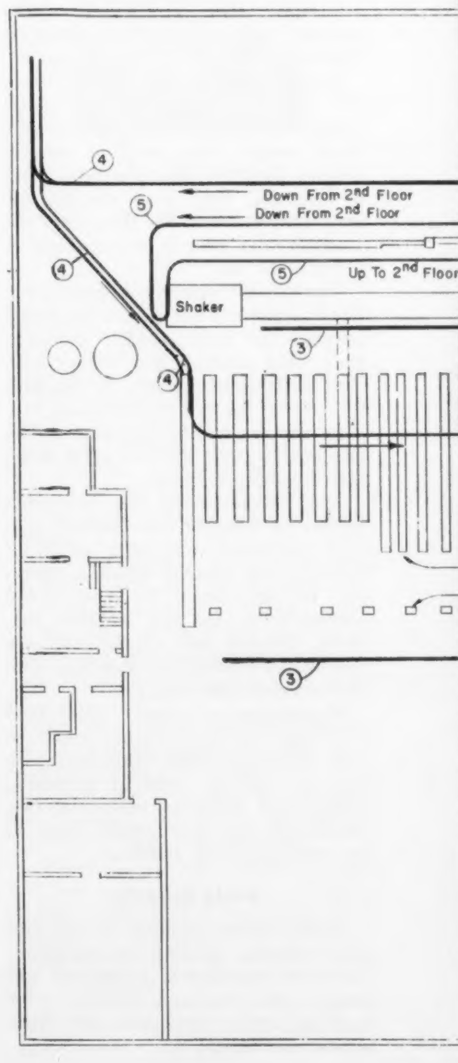
When sand is ready, the operator actuates the dump bucket which lowers into position alongside muller. The press of a button raises the loaded bucket into traveling position.

Near the muller are one electric and three hand-operated switches in the monorail trackage. The muller operator throws the switch that will send the dump bucket down one of seven side tracks to the coremaking station. Six automatic stops along each side track will stop the bucket according to a preset signal given by muller operator. This signal is given by pressing one of six corresponding buttons on a control board near muller. In our installation, no more than six stations are located on any side track.

When the bucket reaches the proper station it dumps automatically and returns to the muller.

Our core room layout is based on the use of monorail systems. Overhead handling enables us to supply the 19 core-blowing machines and 10 core roll-machines and benches that are operating in a relatively confined area.

Although the monorail is a fixed installation, we can expand it when increased production demands require the addition of more core blowers. Since the initial installa-



Five monorail systems integrate production in Forest City foundry. View shows major areas of plant.

tion of the automatic dump bucket in the core room we have added 7 more stations to the system.

Maintenance

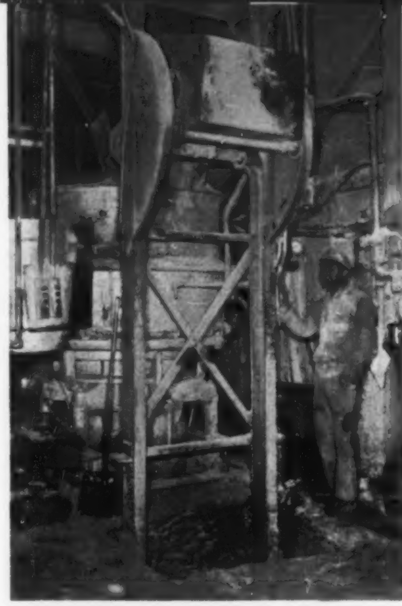
Our core-room installation is relatively complex, but it has not placed a great burden on our maintenance force. We have two dump buckets and operate them alternate weeks. The bucket not in service is placed on a side track near the muller. The core-room maintenance man performs a weekly inspection of the spare bucket. If trouble should develop in the other bucket the stand-by unit can be put in service immediately.

Principal object of weekly inspection is to maintain electrical contacts which pick up power for the electric motor that drives the unit. Our maintenance department stocks spare drive wheels, small gears, and motors for quick replacement. Good service has been aided by muller operators blowing sand from all exposed parts of the bucket every 30 minutes.

A 600-lb load of sand traveling through a busy core room without any human hand to guide it may raise some questions of safety, but the bucket travels at a height of 8 ft where no one is endangered. Maintenance crews using ladders near the monorail must take special precautions.

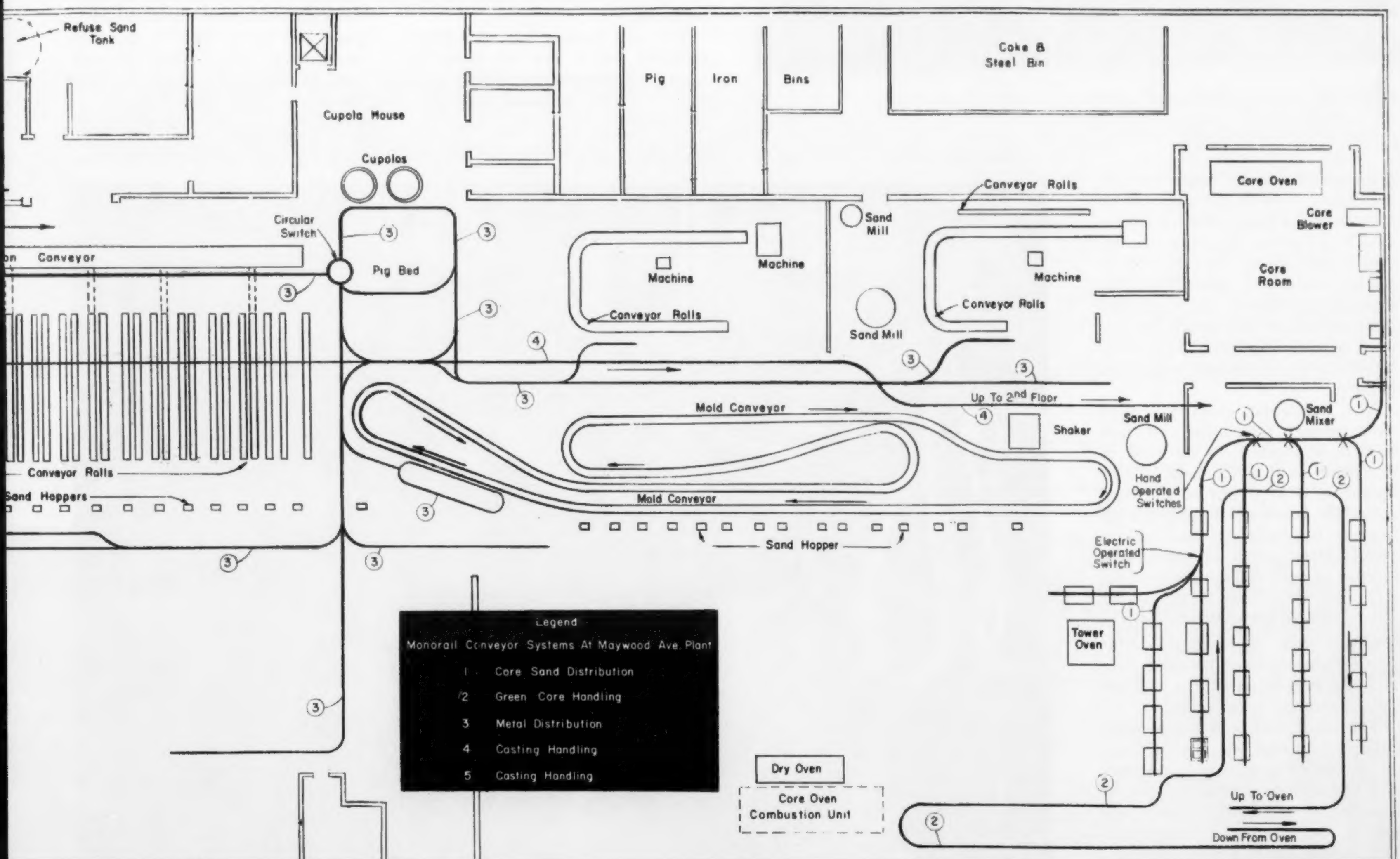
Green Core Handling

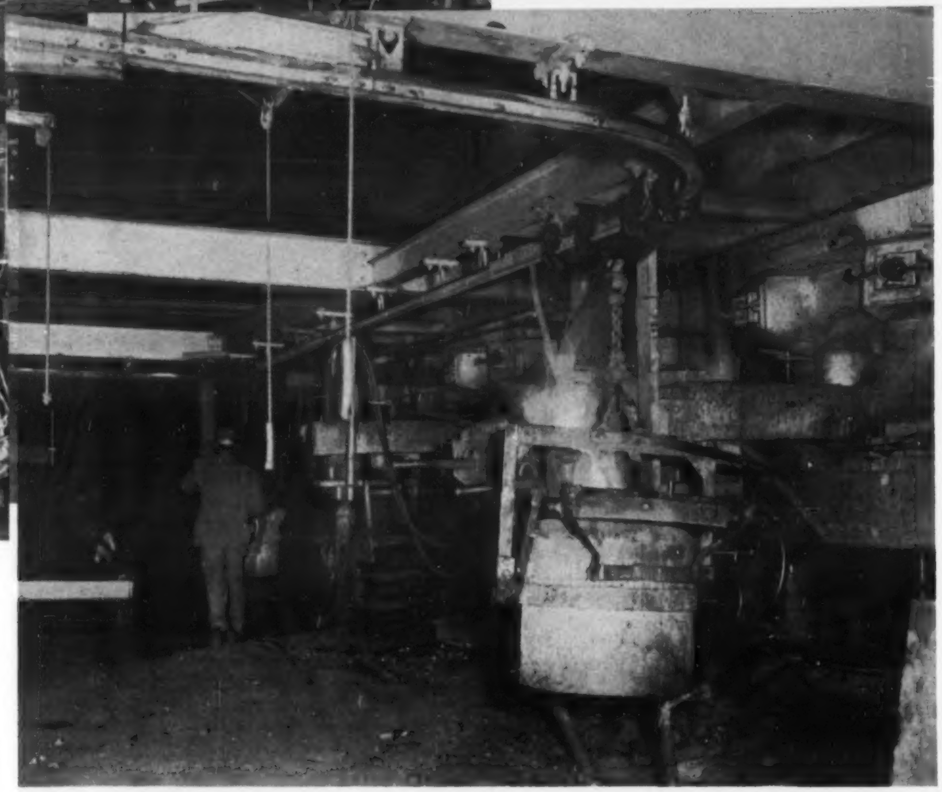
After the sand delivered to the coremakers has been used to pro-



Empty dump bucket is in position for loading as muller is filled.

Remote control system stops and dumps bucket at station.





Main line of metal distribution system terminates at the cupolas.

duce cores, another monorail system takes over to move the green cores into the core oven. This monorail is a continuous, powered conveyor that circles the core room. Racks suspended from conveyor carry cores through the oven and then return to core room for unloading and reloading. The racks travel at a convenient height for loading.

The horizontal conveyor-type oven through which the cores are carried, is located on the roof of the plant so that the heat of this operation is kept out of the core room. The ovens are equipped with burners for both gas and oil, to avoid interruptions in production in case of fuel emergencies.

Metal Distribution

Distribution of molten iron to our semimechanized pouring line and our side floors is also handled by a monorail installation.

The bull ladles and pouring ladles are moved laterally by hand on overhead monohail but raised and lowered by electric hoist. Our installation can handle any number of bull ladles at one time, although 7 or 8 is probably the average number in service. Ladles up to 1100-lb capacity are used.

The semimechanized pouring line is a monorail system that parallels a portion of a car-type mold conveyor. The track is laid out in a loop so that two men may pour-off molds without interference.

The pouring ladle follows the mold and then continues around the circuit to meet the molding line again. Ladles are propelled by hand, but are equipped with hoists for raising and lowering when they receive metal from the bull ladle.

These monorail installations enable our work force to move and pour an average of 16 to 22 tons of iron per hour. Castings range from 1 to 400 lb in size.

This iron distribution system has been in the plant for five years; it replaced an earlier monorail installation.

The new system has non-derail switches which are an improvement over the old equipment. The system greatly reduced the problem of maintenance.

Two continuous, powered monorail conveyors moves trays of castings from the two shakeouts to the cleaning room.

Enroute to the cleaning room, the conveyor carries the castings on a circuitous route outside on the roof of the foundry so they are cool by the time they arrive for cleaning and inspection.

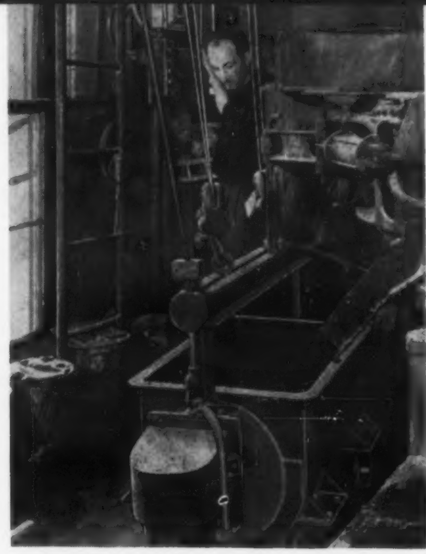
Benefits

The monorail installations at Forest City Foundries have been a part of a planned program of mechanization that has brought benefits to three vital groups: our customers, the people who are employed at Forest City and the company.

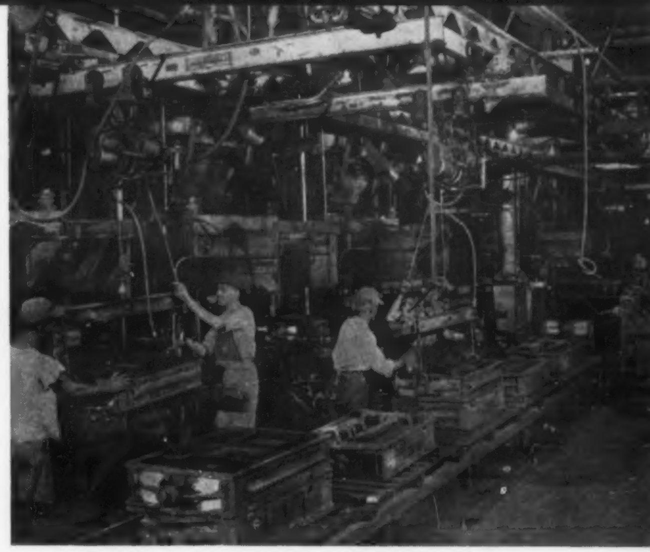
The customer has benefited from improved quality and speeded delivery; the employees enjoy better working conditions; and the company has been able to meet its competition and continue its business of making castings—*a job it has been doing since* 1890.

Metal is transferred from bull to pouring ladle at semimechanized pouring line. Pouring ladle has power hoist.

Charge materials. Cupola charger handles 22 loads per hour, moving charges to four cupolas. Weight of bucket and charge is 4300 lb. Load is hooked and unhooked by operator in cab without assistance of floor men. Charging equipment is manufactured by ***Cleveland Crane & Engineering Co.***



Core sand. Automatic delivery of core sand reduces labor and eases plant layout problems. Operator dispatches self-propelled unit to correct station and bucket dumps automatically. *American Monorail.*



Molds and flasks. Completed drags and copes are set on conveyor line with ½-ton air hoist operating on monorail. The eight machines appearing on this molding line at Dearborn Iron Foundry, Ford Motor Co., are each equipped with this handling equipment manufactured by ***Louden Machinery Co.***

MONORAILS MOVE MANY FOUNDRY MATERIALS

Monorail systems are designed on the theory that only specialized application will assure the full advantages of overhead handling. The metalcasting industry has found that there are many handling operations where these advantages may be fully utilized.

Monorail installations may be incorporated into the design of new plant facilities, but the flexibility of the single track installation also lends itself to application in existing plants. Installations in an existing plant can be a key factor in allowing the plant to gain full advantage from the addition of mechanized equipment.

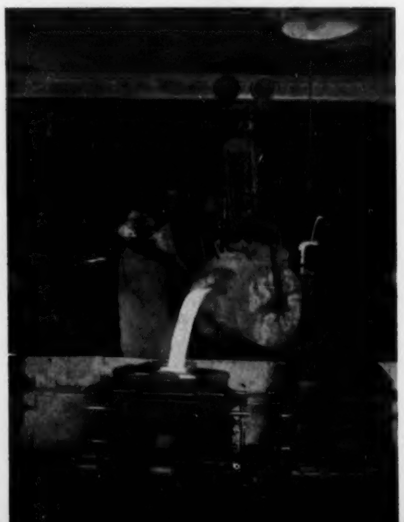
The tracks and switches of a monorail system are basically simple, wear-resisting components that provide long service with little maintenance. This feature, plus the ability of the equipment to handle hot metal and to operate in heated areas, has promoted their use.

Systems in current use range from simple hand-pushed units to extensive electrified systems using remote control and automatic operations.

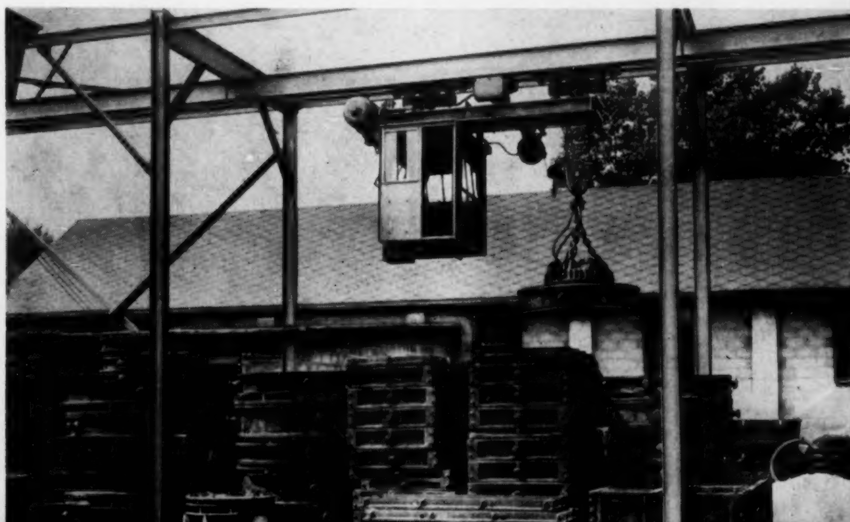
The photographs of typical monorail installations for metalcasting operations were assembled through the cooperation of the Materials Handling Institute, Inc.

Metal transfer. Separate track for pouring and transfer ladles eliminates traffic jams. System is manufactured by ***Whiting Corp.***

Pouring. Pouring ladle on a trolley lets worker follow mold down conveyor. System built by ***David Round & Son.***



Storage yards. Outside storage problems offer many possibilities for monorail applications. This ***American Monorail Co.*** system is used to store copes and drags and to break scrap with a 1000 lb steel ball. Same system can unload and store a car of pig or scrap in 5 hours.



LOW COST WINTER COMFORT

Heaters directing infra-red energy into foundry cold spots may solve your heating problems

Annual fuel savings estimated at 55 per cent have been achieved at AllCast Non-Ferrous Metals Co., Newark, N. J., by using gas infra-red heat generators instead of conventional space heaters. Average monthly operating cost with infra-red is estimated at $17.38 per 1000 square feet.

AllCast had to heat a foundry 40 by 60 feet and 35 feet high. In addition, an adjacent building used for grinding and finishing operations was only partially heated with existing steam unit heaters.

Because warm air from the unit heaters would ordinarily be wasted by rising to the high monitor-top roof, gas infra-red generators were installed in both areas. *Radiant heat warms workmen and the floor surface rather than the air in the building.*

To heat the 2400 sq ft foundry area, six infra-red generators were hung on 20 ft centers 10 ft from side walls and 20 ft above the floor. Two additional generators were hung in the grinding and finishing room. AllCast receives gas with 604 Btu/cu ft mixed gas at 3-inch water column pressure.

Installation cost amounted to $125 per infra-red generator, about the same as for conventional gas heating of the buildings.

The six infra-red generators in the foundry are controlled by one thermostat, and the two infra-red generators in the grinding room by another. Each infra-red generator was fitted with an individual snap switch to cut it out if only partial heating is desired. This feature provides spot heating in unheated buildings during the periods when worker is employed in the area.

Fig. 2 . . . Infra-red heaters are individually switch controlled.

Operating Costs

The real savings in the infra-red system lay in operating economy. Cost estimates of infra-red and conventional gas heating on this job are shown in the table.

COST COMPARISON — INFRA-RED VS. CONVENTIONAL HEATING

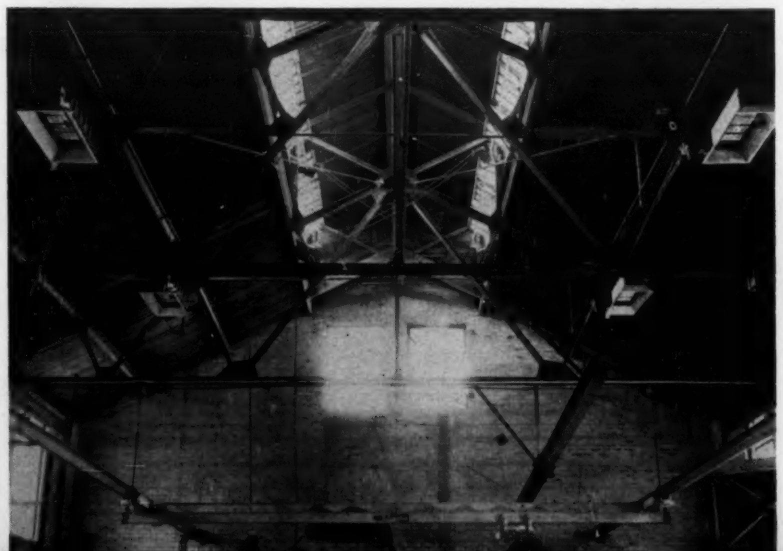
Heat required	Vented Gas Unit Heaters (850,000 Btu/hr)	Infra-Red Heaters (384,000 Btu/hr)
Use factor	2.32	2.32
Gas Consumption	1,972,000 cu ft/yr	890,000 cu ft/yr
Rate	$0.75 / 1000 cu ft	$0.75 / 1000 cu ft
Fuel Cost	$1479.00 / yr	$667.50 / yr

Fig. 1 . . . Units may be 60 ft above floor without losing efficiency.

The new infra-red generators are based on German inventions brought to the U. S. last year. By using the structure which supports combustion as the infra-red emitter, the unit by-passes one stage in previous processes of gas infra-red generation. No metal strips or louvers are needed. Thus higher operating temperatures are feasible and, as a result, a maximum proportion of the gas Btu input is converted into usable infra-red. The units may be installed as high as 60 feet from the floor without impairing their efficiency.

Generator models for indoor use have been approved by Underwriters Laboratories and American Gas Association. Under normal service conditions life expectancy of the generators is unlimited.

Fig. 3 . . . Foundry floor, 40 x 60 ft, is heated by six generators.



DIE CASTING

- **ADVANTAGES**
- **MACHINES**
- **ALLOYS**
- **DESIGN**
- **COMPETITION**

by Gustav Lieby

Material in this special Bonus Section is based on Gustav Lieby's book, Design of Castings, *published by the American Foundrymen's Society. First published in German by Franchk'sche Verlagshandlung.*

A MODERN CASTINGS
BONUS

This report is the 29th in a monthly series presented by MODERN CASTINGS to analyze vital problems in the industry. A limited number have been reprinted and are available for 50 cents each.

During the past 10 years the upward trend in the production of die castings has set the pace for the entire casting industry. In an industrial economy keyed to mass production, die casting has proven its adaptability to mechanization, automation, and imagination. Although casting is said to provide the shortest route from raw material to finished product, *Die Casting* does it faster and often cheaper than any other casting technique.

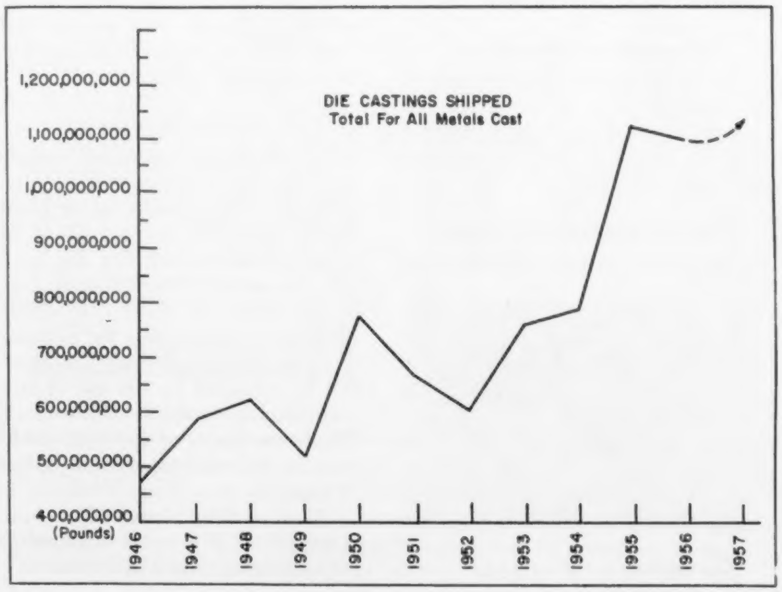
With all other phases of the casting industry lagging behind their 1956 output, die casting is headed for a record breaking year. Aluminum die casting production in 1957 is expected to total 385,000,000 lb, a gain of 18,000,000 lb, or 4.9 per cent over the 1956 all time high. Of the total aluminum going into castings in 1957, die castings will use 50 per cent, compared with 47 per cent in 1956.

This Bonus Section has been prepared to help:

Die Casters—learn more about their process.

Foundrymen—become familiar with their competition.

Buyers and Designers—improve their products by intelligent use of die castings.



Die Casting: ADVANTAGES

Castings produced by the hot- or cold-chamber die-casting process are distinguished by their characteristic accuracy, smoothness, and surface quality. In comparison with other metal working methods, die castings are made with minimum expenditure of metal and, in general, are accurate in size to the extent that very little or no subsequent machining is necessary after removal of the gate and flash.

The following information with regard to processing of die castings is intended to familiarize the designer with the properties, advantages, and limitations of this highly developed precision casting process for metallic materials.

Table 1 — DIE CASTING WALL THICKNESSES

Minimum Wall Thicknesses For (Sn, Pb, Zn) low-melting heavy alloys, in.	(Al, Mg) high-melting light alloys, in.	(Cu-base) high-melting heavy alloys, in.	surface area of the die cast part*
0.0236 - 0.0394	0.0315 - 0.0471	0.0589 - 0.0787	up to 3.875 sq in.
0.0394 - 0.0589	0.0471 - 0.0707	0.0787 - 0.0982	3.875 to 15.5 sq in.
0.0589 - 0.0787	0.0707 - 0.0982	0.0982 - 0.118	15.5 to 77.5 sq in.
0.0787 - 0.0982	0.0982 - 0.118	0.118 - 0.157	over 77.5 sq in.

*The area of a single main plane to be produced at minimum wall thickness.

Table 2 — MAXIMUM DIMENSIONS AND WEIGHTS OF CASTINGS

Alloy	Lead	Tin	Zinc	Magnesium	Cu-Alloy	Aluminum
Wt., oz.	0.018-36	0.018-18	0.018-714	To 285	To 178	To 357
Max. Size, in.						
Length	12	14	32	32	16	32
Width	8	10	24	24	10	24
Depth	8	10	12	12	6	12

Technique of Filling Die Cavity

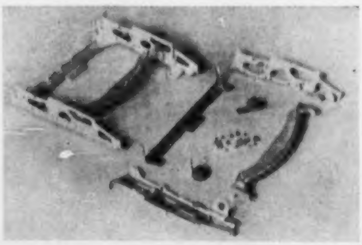
As the name "die casting" implies, pouring of the molten metal into the mold or die cavity is done under pressure. The thin walls, as well as the various bends around the corners and edges of complicated die castings, offer considerable resistance to complete filling of the mold or die. Therefore, it is necessary that the metal moves through the die with high velocity before it settles in the mold cavity.

Dimensional Tolerances

The most important advantage of die-cast products is the maximum possible dimensional accuracy that can be obtained by the casting processes.

Reduced Machining Costs

The savings possible due to elimination or minimizing of machining operations is usually between 30 and 50 per cent; although it is possible to save as much as 90 per cent. Due to their smooth and clean surface, quality die castings have excellent appearance.



Conversion to die casting.

Wall Thickness

The smallest possible wall thickness can be obtained with a die-cast part. Thick walls are not desirable because the possibility of gross porosity exists. For die castings, the wall thickness should, only in exceptions, be above 0.157-0.192 in. Reinforcements, for the purpose of increasing strength and stiffness can be acquired by the use of ribs maintaining uniform thicknesses. The lower limits of the wall thickness to be maintained are given in Table 1.

On the other hand, there are cases where it is more economical and advantageous when constructing dies for large castings, to divide the large part into several simple components.

Cost Reduction

Reduction of production costs of an article is achieved by combining in one casting, parts which were made separately by other manufacturing processes. By such integration the following are effected:

- a reduction of assembly costs;
- a reduction of the metal cutting work due to elimination of machining at the joints;
- a higher rigidity, since the component assembled from several single parts is usually less rigid.

As the cost of a die for such a die casting will be very high, processing of the part requires, in most cases, the highest skill of the producer. For this reason, the design of the part has to be definitely established or finalized. A large

enough number of parts must be made to defray die costs and to make the die-casting process compare favorably in relation to the piece price of other fabricating processes.

The figures in Table 1, based on experience, serve only as a guide. Wall thickness, first of all, depends on the type of casting, on the metal flow in the die, and on the position of the gate. Even in larger parts, it is possible to provide for a smaller wall thickness in some places, providing this portion does not extend over the whole cross section.

Production Rates

The die-casting process has the advantage of lending itself to high production. Complicated parts of medium size can be produced in amounts of 200 and more parts per hour by using modern casting facilities. Small parts of low-melting heavy metal alloys can be produced in amounts of 1000 pieces per hour without difficulty by the use of fully automatic die casting machines.

Die Casting: MACHINES

There are two general types of die-casting machines, as identified by the placement of the metal in the injection chamber.

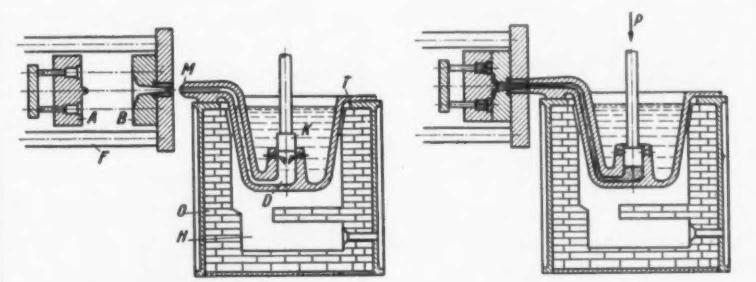
The hot chamber (pressure) die-casting process:-Molten metal is forced under pressure (about 370–4400 psi) into a permanent mold or die made of steel. The chamber where the high pressure is produced or to which it is directed contains the molten metal bath. In any case, the pressure chamber (called hot chamber) is heated at least to the melting temperature of the metal to be processed. Generally a plunger is applied to produce pressure.

Compressed air or other gas under high pressure is frequently used. The former type is called a plunger die-casting machine; the latter, an air-operated die-casting machine.

The cold-chamber process: In this process the material can be processed in a plastic state. It is not necessary to maintain the metal injection chamber at the melting temperature of the alloy. The chamber (called cold chamber) is separated from the melting pot and is not heated. The material being in a plastic condition is compressed (about 3000-14,700 psi) by means of a plunger and hereby liquefied to fill the steel die cavity.

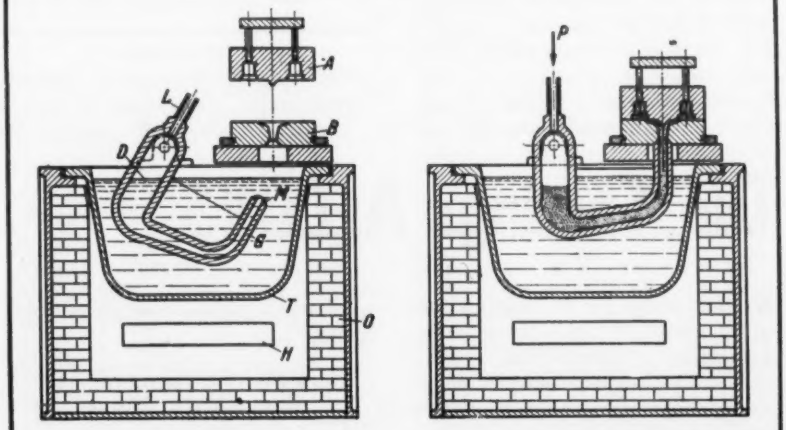
The material can also be processed in a completely liquid state. Cold-chamber casting machines are also called plunger casting machines.

Figures 1–4 illustrate the working principle of some types of die-casting machines utilizing hot or



a) Die opened b) Die in pouring position

Fig. 1 . . . Hot-chamber plunger-type pressure-casting machine shown with the die opened in left drawing and in pouring position on right. Parts are: A, ejection die: B, cover die; F, machine tie bars; M, orifice; T, crucible; D, cylinder; K, plunger; O, furnace; H, heating chamber.



a) Die opened b) Die in pouring position

Fig. 2 . . . Hot-chamber, pneumatic die casting machine showing die opened on left with gooseneck tilted and die in pouring position is shown. The identified parts of the machine are: A, ejection die; B, cover die; M, orifice or nozzle; G, gooseneck; T, crucible; D, pressure chamber; L, pressure line; O, furnace; H, heating chamber and P, pressure.

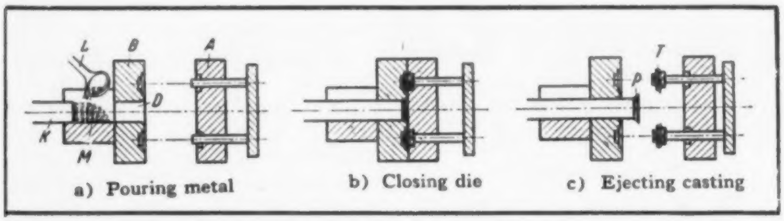


Fig. 3 . . . Operating principle of the cold-chamber pressure-casting machine. Pressure chamber in this unit is located within die. Parts are: A, ejection die; B, cover die; T, die casting, E, sprue; M, metal; K, plunger; P, butt; R, ejector piston; D, pressure chamber; and S, ejector pins.

cold chambers. For die-casting machines, molten metal is brought mechanically or automatically to the pressure chamber or the ladle, respectively. The metal has to be ladled into the chamber when the cold-chamber machine is used. For this reason the output of castings is usually higher with the hot-chamber machine. However, cold-chamber casting machines have been developed embodying automatic filling of the chamber.

Die-casting machines with auxiliary equipment vary greatly in performance. The entire casting machine (cold-chamber casting machine including melting furnace) has to accomplish the following:

- hold the metal in a state ready for pouring;
- press the amount of metal as needed for the desired part into the die under the required pressure; and
- receive the mold or die and operate it in accordance with required movements.

The hot and cold-chamber casting machines are operated manually, mechanically, or by means of hydraulic pressure and compressed air.

There also are completely automatic die-casting machines,, referred to as die cast automation. Another recent development is vacuum die casting which produces castings with improved physical properties.

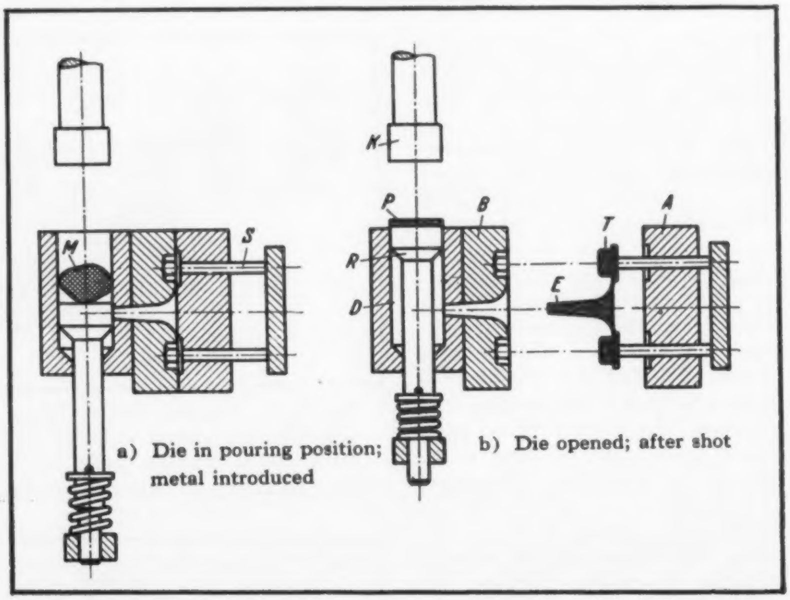


Fig. 4 . . . Cold chamber machine with pressure chamber outside die. Parts are: A, ejection die; B, cover die,; T, casting; E, sprue; M, metal; K, plunger; P, butt; R, ejector piston; D, chamber; S, ejector pin.

Die Casting: ALLOYS

Metal alloys for die castings can be classified into three main groups:

1. Low-melting temperature heavy metal alloys with the base metals lead, tin and zinc,
2. High-melting temperature light metal alloys with the base metals aluminum and magnesium.
3. High-melting temperature heavy metal alloys with the base metals copper and silver.

The alloys in Groups 1 and 2 are used predominantly as die-casting alloys.

Low-Melting Temperature Heavy Metal Alloys

Lead-Base Alloys. Lead die casting alloys always contain varying amounts of zinc, antimony and copper, besides lead. They are used as type and bearing metal. Addition of antimony serves to increase the hardness.

If the temperature of the molten metal is maintained properly, these alloys can be processed under a small pressure without difficulty in plunger type casting machines. Due to the low heat content of the alloy which is removed during solidification, complicated castings often have an unclean floral appearance. Die castings for the chemical equipment industries, slide bearings, as well as letters of all kind, are made predominantly of lead alloys. The parts are plas-

Fig. 1 . . . Aluminm die castings made of an Al-Mg9 alloy.

tically deformable, i.e., they can be curled and riveted. Without surface protection they oxidize but they are resistant to corrosion. The strength figures are low (7,000–11,000 psi). Therefore, these die castings can be used only for low-stressed parts.

All lead alloys form poisonous salts in contact with organic acids. Their use in the food industry or in parts which are frequently handled by hand is, therefore, not permissible. However, they can be galvanized or varnish coated.

Tin-Base Alloys. Tin alloys usually contain antimony and copper since both increase hardness and strength. Lead is added only to reduce cost, since tin is relatively expensive and rare. Tin alloys are processed by the hot-chamber die-casting method. Normally plunger-type machines are used.

Complicated castings can be manufactured with greatest dimensional accuracy since there is little tendency for contraction and the forces of shrinkage are small. As the metal does not stick to the wall of the die, castings strip easily. Consequently, long cores can be poured cylindrically or with only the minimum draft.

High lead content enhances formation of cold shuts. The parts are workable and can be flanged and riveted. A surface treatment by cladding with other metals or by varnishing is easily possible. Tin alloys are stable against atmospheric conditions and can be polished. The polished surface will remain bright for a long time in dry air.

Parts having special smooth surfaces, precise dimensions and resistance to corrosion but low mechanical and thermal resistance are best made from tin-base alloys.

Zinc-Base Alloys. Zinc alloys are most suitable materials for die castings. The alloys always contain aluminum or aluminum and copper in addition to zinc. A tin content as low as 0.001 per cent can produce intercrystalline corrosion. Some zinc alloys containing aluminum show a tensile strength and rupture resistance up to as high as 55,000 psi.

To minimize attack of molten metal on iron, zinc alloys should contain at least 0.5 per cent aluminum. The standardized zinc die-casting alloys have higher aluminum contents. If the aluminum content exceeds 4.3 per cent, the impact strength drops.

Only in the case of special purity alloys does the aluminum content exceed 5 per cent. Addition of copper has the effect of increasing the strength properties, but it impairs the dimensional accuracy.

Processing

Cold-chamber and air-operated machines are often used for production of large parts, whereas, normally, plunger-type machines with a hot chamber are utilized. It is possible to produce castings with very thin walls.

Zinc die-cast parts can be machined easily with metal cutting tools shortly after pouring.

Checking Stability

Dimensional precision is not as good as with tin-base alloys. Cores and other places of shrinkage of zinc die-cast parts should have a small taper (0.2–0.4 per cent of the length) to permit easier ejection of the casting or pull-back of the core.

The surface of the parts exposed to the air slowly loses its original metallic luster, but alloys of high purity are unaffected by the atmosphere. Protective coatings increase the stability of highly stressed parts. Pickling in itself imparts a measure of protection against corrosion damage.

Chromizing imparts corrosion resistance to valves and other parts. In addition, phosphate coating, which is superior to chromizing for wear and corrosion resistance, is used for surface protection. Air-drying lacquers should be used, whenever possible, for coating. Baked-on lacquers may damage the casting metal due to the high baking temperature used, but since lacquers adhere better, they are often used.

Surface Treatments

In most cases asphalt and oil lacquers should be avoided. Synthetic resin lacquers baked on at temperatures not in excess of 250 F (120 C) are preferable. It is advantageous to pickle the parts to obtain better adherence of the lacquer. The chrome or phosphate coating is a good lacquering base.

Surface coloring can be achieved by various methods. Protection against corrosion by such coatings is small. Parts can be permanently colored black by means of anodic oxidation. A good protective coating can also be obtained by anodic chrome-plating in a galvanizing bath. If the surface density of the casting is high and pure alloys are used, platings can be made with other metals. To obtain good results from nickel plating, a copper or brass layer should be applied first. Chrome plating can be done directly and generally gives sufficient protection.

Zinc die castings may show changes with time, i.e., aging. The parts undergo dimensional changes and reduction of strength properties at normal temperature. The degree to which these undesirable changes take place depends largely on the purity of the alloy used. Proper choice of the alloy and the

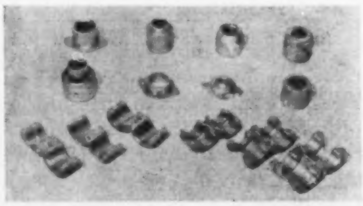


Fig. 2 . . Camshaft bearings and parts from light metals.

Table 1 — COMPARISON OF MECHANICAL PROPERTIES OF DIE CAST ALUMINUM ALLOYS
(Determined by Specially-Cast Test Bars)

Material and Process	Tensile Strength, psi	Elongation % in 2 in.	Brinell Hardness
Al-Si die casting Hot Chamber	32,000-36,000	2.8 - 1.5	60-80
Al-Si die casting Cold Chamber	36,000-40,000	4.0 - 1.8	75-80
Piston Alloy Al-Si-Ni (Die-Cast)	39,000-44,000	1.5 - 1.0	100-120
Piston Alloy Al-Si-Ni (Die-Cast, aged)	40,000-46,000	1.0 - 0.5	110-130

use of purest virgin metal has reduced this "aging" of castings to where it is no longer a matter of practical concern. Alloy Zn-A14 is preferable for parts of high-dimensional accuracy. Plastic workability of zinc die castings is limited depending on the kind of forming.

Uses

Zinc die castings are used in the automobile, electrical, and optical industry. They are used for carburetors, vacuum cleaners, measuring devices, office equipment, cash registers, printing and calculating machines and apparatus of different types.

Zinc-base alloys, due to their good flowability, their acceptable strength figures, and their good machinability, are assured of a wide range of applications when processed by diecasting methods.

High-Melting Temperature Light Alloys

■ **Aluminum-Base Alloys.** The aluminum alloys can be divided into three main groups depending on the alloying metal:

- Al-Cu alloys (up to 8 per cent Cu)
- Al-Si alloys (up to 13 per cent Si)
- Al-Mg alloys containing up to 10 per cent Mg

Aluminum alloys, due to their relatively high melting point and the tendency to pick up iron, are processed primarily by air-operated cold-chamber machines. The cold-chamber machines prevent absorption of iron by the molten metal since the melting takes place in a graphite crucible. Too high an iron content makes the material hard due to the formation of Al_3Fe intermetallic compound. Impurities of tin and zinc should not be higher than 0.3 per cent.

Aluminum-copper alloys show high mechanical strength and are used for simple castings with not too thin walls. The copper content reduces the chemical stability of the alloy. The parts should not be exposed to sea water.

Aluminum-silicon alloys have particularly good flowability and, therefore, are preferred for thin-walled and complicated castings. The higher the Si content the lower the viscosity of the melt; but this reduces workability of the casting (flanging or riveting).

The eutectic Al-Si alloy (13 per cent Si) is highly corrosion resistant, even higher than pure aluminum to alkali.

Aluminum-magnesium alloys with a predominant magnesium content, i.e., the Al-Mg, Al-Mg-Si, Al-Mg-Mn types are highly resistant to corrosion and maintain a bright surface without protective coating. Parts made of Al-Mg type alloy may be brought in contact with water.

Highly polished parts are often used as substitutes for nickel or chrome-plated heavy metal products. The Al-Mg-Mn type alloy is resistant to sea-water corrosion; but due to the pronounced hot shortness only relatively simple die castings can be made from these alloys.

Chemical Stability

All alloys are fairly stable chemically, due to the natural oxide coating. Alloys are generally stable toward diluted alkali in the presence of acids, salt solutions, and other chemical media.

Surface Treatments

Aluminum alloys can be electroplated, but the processes now in use are expensive and the coating does not adhere on some alloys as well as on heavy metals. Al-Si alloys are best suited for electroplating. Pickling in acids and bases gives a uniform white appearance to the castings which improves the quality of the surface. The parts can be coated with air-drying varnishes as well as with baking lacquers.

Surface hardness, resistance to wear, and corrosion resistance can be increased considerably by anodizing. The oxide coating is made thicker if anodized by electrolytic means. Because of the sudden and non-uniform quenching process common to the die-casting process, castings show a heterogeneous structure which will have an unfavorable influence with reference to anodic treatment. Protecting effect are not inhibited, however.

A subsequent treatment is recommended to improve appearance if the anodic oxidation is not used as a base for lacquer coatings.

Aluminum alloys of predominant magnesium addition are well suited for anodic treatment. A general rule is that alloys low in heavy metals and free of silicon are easier to treat anodically than those rich in heavy metal and silicon. Anodic treatment has shown excellent results on screw threads subjected to strong corrosion as well as in the assembly of light metal components with parts of other metals. This is also true of surfaces subjected to much friction.

Other Considerations

Die castings of aluminum alloys are generally more expensive than comparable zinc die castings. Tensile strength and hardness are somewhat lower. More subsequent finishing work is required, since dimensional accuracy in processing is less than with zinc casting.

Aluminum alloys have the following important properties with reference to their application:

- Low density (2.7 gr/cu cm).
- Excellent chemical resistance.
- High electrical conductivity.
- Stability of structure.

Uses

Die castings made from aluminum alloys are used to advantage for many applications in all industries. The above-mentioned excellent properties are best put to use in the construction of electrical, optical, and chemical apparatus; for household appliances, and utensils for the food industry; as well as in castings for automobiles and airplanes.

■ **Magnesium-Base Alloys.** Magnesium casting alloys always contain a certain percentage of aluminum. In order to increase the hardness, a small amount of zinc is added to those alloys. The alloy predominantly processed by the die casting method is of the following composition: Al, 7.6–10 per cent; Zn, 0.1–1.0 per cent; Mn, 0.1–0.5 per cent; remainder is magnesium.

Processing

Magnesium alloys are processed chiefly by the hot-chamber method using plunger type and air-operated casting machines. Pouring of the alloys is difficult, requiring considerable experience, since the alloys are easily oxidized in the molten condition. Nitrogen in the air combines with the metal; consequently only melting under vacuum guarantees high purity for the alloys. For this reason the cold-chamber casting process is normally not desirable since there is a chance for air contact when the molten metal is ladled into the chamber. Devices have, however, been developed which allow the use of cold-chamber machines.

Contrary to aluminum, magnesium-base alloys in the molten condition do not attack iron. It is possible to process the most complicated castings when utilizing the high fluidity of the metal. Small holes and slots can be cast integrally and the tapers should be less than for aluminum alloys. Due to rapid cooling of the casting in the die casting process, the metal becomes brittle; therefore magnesium alloys cannot be flanged or riveted. Soft alloys (such as the standardized alloy Mg-A16) are workable or deformable to a certain extent.

Chemical Stability

Magnesium is not absolutely resistant to atmospheric influences. The oxide layer, which imparts a dull gray appearance to the parts, offers a natural protection which is improved by oiling, pickling, or lacquering. Parts which are exposed to water, acids, and salt solutions should not be made of magnesium alloys. These alloys are resistant to alkali, soap solutions, acid-free oils, and hydrofluoric acid.

Surface Treatments

The bichromate method is most suited for pickling. Here the magnesium casting is pickled in a nitric acid-bichromate mixture for one minute. The yellow chromate compound which precipitates protects

Table 2. DIE-CASTING MATERIALS

	Low-Melting Heavy Metal Alloys			Light Metals		High-Melting Heavy-Metal Alloys
Properties	Pb Alloys	Sn Alloys	Zn Alloys	Al Alloys	Mg Alloys	Cu Alloys
Density, lb/cu in.	0.310-0.401	0.256-0.289	0.242-0.249	0.093-0.104	0.065	0.289-0.307
Melting Point, °F*	621	450	786	1216	1202	1981
Specific Heat, cal/°C*	0.032	0.055	0.09	0.22	0.24	0.09
Linear Expansion per °F*	16.2	15	16.2	13.2	14.5	9.4
Thermal Conductivity* G.G.S.	0.084	0.15	0.26	0.5	0.4	0.9
Electric Conductivity* m/ohm/mm²	4.8	8.3	16.5	35	25.6	56
Tensile Strength, psi	7,000-11,000	11,000-16,500	31,400-54,200	25,700-35,700	23,000-34,300	35,700-100,000
Elongation, %	20-3	2.5-1.1	6-2	2.6-1	2-0.5	10-1.5
Brinell Hardness	9-18	26-30	80-120	60-90	60-70	80-120
Usual Alloying Metals	Sn, Sb, Cu	Sb, Cu, Pb	Al, Cu	Cu, Si, Mg, Mn	Al, Zn, Mn	Zn, Sn, Sb, Pb
Corrosion Resistance to Air and Water	Slowly oxidize in air, otherwise stable.	Very high stability	Stable; caution with water	High resistance to corrosion.	Stable in general, not to water.	High stability, especially toward water.
Protective Coatings	Electroplating, lacquering; air-drying lacquers if possible			Electroplating limited; lacquering	Electroplating difficult; lacquering	Electroplating excellent; lacquering
Processing	plunger type or p.t.d.c.m.**	p.t.d.c.m.	p.t.d.c.m. and air-operated c.m.	Air-operated; plunger die-casting machines	p.t.d.c.m.**; air-operated	Plunger die casting machine

*Values for pure metals only; values for alloys deviate. **Piston-type die-casting machine

the surface and serves well as a base for subsequent lacquers.

The added protection obtained from pickling is sufficient against slight corrosive influences. Careful lacquering with baking lacquers imparts the best resistance to corrosion. However, the parts must be pickled just prior to lacquering in order to obtain better adherence of the lacquer to the casting.

Best results have been obtained with acid-free bakelite primer lacquers which are baked on at about 355 F (180 C). This primer may be coated with an acid-free varnish of any desired color.

Magnesium-base alloys may be electroplated under certain conditions, but the practice is not generally used. Coating with other metals by metallizing has been applied with good results.

Electro-chemical oxidation methods can be used with magnesium as with aluminum alloys to increase surface hardness and resistance to corrosion. These methods increase corrosion resistance as well as surface hardness to a greater degree than pickling. Particularly great hardness is obtained if oxide coatings containing inorganic components are produced electrolytically. These methods, however, are more expensive than the simple bichromate pickling.

Uses

Besides their low density, magnesium die castings show a high rigidity and are applicable for parts for radio, photographic, movie, and other optical instruments as well as office appliances. Parts for automobiles and airplanes and parts containing oil can be made advantageously. Excellent machinability of the magnesium alloys also results in considerable saving of actual working time on parts requiring subsequent mechanical treatment.

High-Melting Temperature Heavy Alloys

■ **Copper-Base Alloy.** It has been possible only since the introduction of the cold-chamber casting method to mass produce high-melting temperature heavy-metal alloys. Today, high-melting heavy-metal alloys are processed exclusively by the cold-chamber casting method. Since the material is initially in a semi-plastic condition, high pressures may be used without too much thermal stressing of the die. This reduces melting loss and decreases die wear.

The processing of iron alloys, which can be classified as high-melting temperature heavy-metal alloys, by the die casting method presents many difficulties; but can be done successfully in special cases.

Copper-Base Alloys. "Hard brass" or "screw brass" (58 Cu; 40 Zn; 2 Pb) and wrought brass (60 Cu, 40 Zn) are mostly used as die casting material. Die castings made of "hard brass" machine easily with metal cutting tools. Brittleness of the material increases with lead content, thus decreasing workability. Cast brass and special brasses of ally types as well as special bronzes are processed by the cold-chamber casting method. Bronzes show greater strength and hardness.

A brass with 81.5 Cu, 12.7 Zn, 4.8 Si can be used as material for particularly complicated and thin-walled parts because of its high fluidity. This "special bronze" is primarily used for cold-chamber castings.

Die castings of brass and other copper alloys find extensive application in all branches of industry. They reveal good chemical properties and high resistance to corrosion. The heavy-metal alloys are well suited for finishing by electroplating with chrome and nickel.

Comparison of the Alloys

Zinc-base alloys, which approach gray cast iron in strength, are used most often as material for die castings. Because of their good workability, the elongation figures of zinc-base alloys in relation to strength can be considered satisfactory.

Aluminum-base alloys have low weight, high strength, good chemical stability, and high electric conductivity. The lightest commercial metal, magnesium alloy, offers in addition to great savings and good load factors, the advantage of good machinability permitting cutting speeds and feeds comparable to those used in wood cutting.

Die Casting: DESIGN

Every casting (including die castings) contracts on solidification, i.e., a volume reduction takes place on cooling from the liquid to the solid state. Cooling permits ejection from the mold (die) without deformation. It results in forces of shrinkage and contraction which must be overcome when the casting is ejected or when the cores are removed. When designing large die castings, shrinkage must be considered.

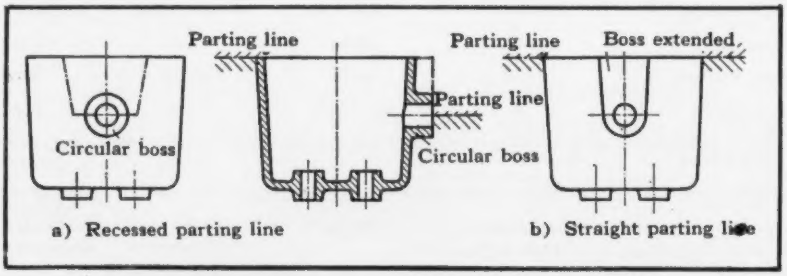


Fig. 1 . . Simplification of parting line on housing design.

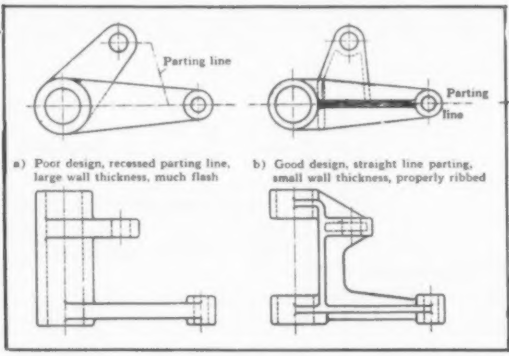


Fig. 2 . . . Redesign (on right) of die casting for straight line parting.

Shrinkage During Solidification

Due to complete rigidity of the steel die, the total volume change during solidification and cooling is made of:

- change in volume of the molten metal,
- change in volume on solidification (till the casting is removed from the die),
- change in volume on cooling to room temperature (casting can change unrestricted).

All alloys show a contraction in volume on cooling in all three stages. Since only the solidified casting can be ejected from the die, the metal casting must not be subjected to cracking by hindering contraction and must not build up excessive stresses until the temperature of ejection has been reached. The die designer must estimate the correct shrinkage for each section of a casting, considering the proper working conditions. Shrinkage values in Table 2, as evaluated from measurements of various parts, should be used only as rough approximations and for comparative purposes between the individual alloys.

Not every alloy is suitable for the production of large die castings and the metal to be used must possess a certain amount of ductility.

The term "shrinkage" in casting practice stands not only for a characteristic but also has a dimensional meaning. It is the change in dimensions (in per cent) of the cooled casting from the dimensions of the die at operating temperature. For the design and construction of dies, shrinkage is important because it determines the percentage of the cooled casting from the original dimensions of the cold die.

Determination of the correct casting shrinkage allowance is complex and requires experience. Since the amount of shrinkage is not dependent on the casting alone but also on its shape, position and length of contact time in the die, as well as on the heat transfer during this time, the shrinkage can be different at different points of the same casting. For this reason shrinkage values for certain alloys have no practical value.

In order to minimize these contraction stresses and to avoid damage to the surface, the die casting must be designed with certain tapers or drafts. A differentiation should be made regarding:

- outer surfaces from which the material shrinks,
- core surfaces upon which the material will shrink.

Amount of Draft

The amount of draft with reference to position depends on the arrangement of the die-cast part in the die.

Usually, outer surfaces can be cast in two parallel planes, whereas core surfaces in most cases require a small taper.

The dimension for the factor (n) of one-sided tapering of contraction surfaces arranged vertically to the parting plane or in the direction of core pull is generally dependent on the shape, die casting alloy, the area of the contracting surface and the wall thickness. Most important for the magnitude of taper (n), however, is the depth (t) of the core surface (if the material is known) so that it is well to state the minimum required taper in per cent of this depth and designate it by (Kt). The influence of the wall may be disregarded since large differences are not encountered here.

It should be noted that under

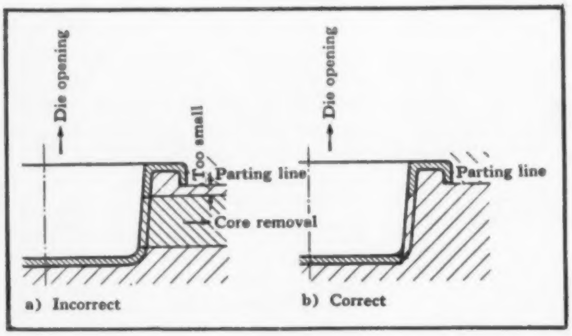
Table 1. DRAFT FOR DIE CASTINGS

Minimum Draft Per Surface at Maximum Core Width of 4.0 In.

	Draft for Part Outer Surfaces		Draft for Internal Core Walls Core Retracted for Ejection		Draft for Fixed Internal Core Walls	
Alloys	Kt in % of depth (t)	not smaller than, in.	Kt in % of depth (t)	not smaller than, in.	Kt in % of depth (t)	not smaller than, in.
Pb, Sn	0-0.1	—	0.1	—	0.2	
Zn	0-0.2	—	0.2	—	0.4	0.0012
Mg	0-0.3	—	0.3	0.0012	0.6	0.002
Al	0.2-0.5	—	0.5	0.002	1.0	0.004
Cu	1-1.5	0.002	2.0	0.004	4.0	0.008

Table 2. SHRINKAGE ALLOWANCES FOR DIE CASTINGS

Alloy Group	Low-Melting Heavy Alloys			High-Melting Light Alloys		High-Melting Heavy Alloys	
Base Metal	Pb	Sn	Zn	Al	Mg	Brass	Al-Bronze
Shrinkage dimension in length, %	0.3-0.5	0.2-0.4	0.5-0.7	0.4-0.6	0.5-0.7	0.7-1.0	0.8-1.2



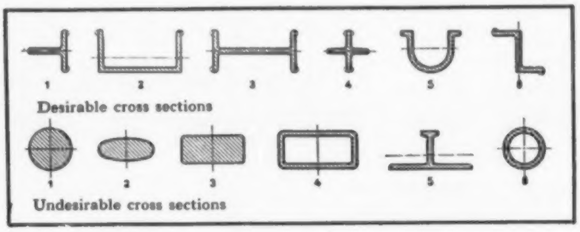


Fig. 4 . . . Profile of cross sections.

Fig. 3 . . . Redesign to avoid undercuts.

given conditions a movable core which is pulled away from the casting in core pull direction and is supported at the front face, requires less draft than a fixed core where the casting is pushed away by means of ejection pins. The former type of die is more expensive, but often must be used when the castings are bulky and thin walled. The latter type can be chosen for simple and large parts.

Parting Line

Just as for sand castings, the parting line arrangement for die castings should be as simple as possible (outer die). The main parts of a die, the two halves wherein the casting rests, should be as straight-lined and even as possible along the parting line. The casting will then be cleaner and more precise, and the die will be cheaper than in the case of recessed or even curved parting lines of the mold (die).

A straight, even parting plane can also be ground easily and precisely with a surface grinding machine; this is important since the two halves of the die will be in the heat treated condition. If the parting plane is complex, trimming flash is an added expense and time consuming. Figures 1 and 2 show that small alterations of the casting result in a simple, straight parting line of the die.

It is preferable to design the external shape of a die casting without undercuts if at all possible because they require core pulls or slide-plates in the mold. However, often undercuts cannot be avoided and may even be desirable for better venting of air. The design should be made to keep the number of slide plates to a minimum. Avoid arrangement of more than four large slide plates.

Undercuts and Cores

However, often undercuts cannot be avoided and may even be desirable for better venting of air. The design should be made to keep the number of slide plates to a minimum. The arrangement of more than four large slide plates should be avoided. However, a complicated casting may still be produced advantageously if there is no cross movement or intersecting movement of the slide plates which line in one plane. Knurls and serrations should not be used as grip surfaces on knobs and screw caps. A proper design will be attained by the use of longitudinal grooves with smallest pitch of 0.039 in., multiple-edged surfaces, and other properly shaped contous which should run vertical to the parting line, possibly tapered.

Avoidance of undercuts in internal openings should be a strict rule. Although sectional and collapsible cores are possible they reduce the casting rate considerably.

Figure 3 shows redesigned construction for the elimination of undercuts. The redesigned casting allows the side opening to be made without side core.

Casting Section

Figure 4 shows several sections which are favorable for die castings. The undesirable designs, No. 2 and 3, should be avoided if the thickness exceeds 0.394 in. In thick walls shrinkage is to be expected in the center; this results in a surface condition in the form of "sinks".

The undesirable cross sections, No. 4, 5 and 6, can still be used for processing small parts (maximum about 20 in.). However, they require core pulls which result in additional expense. This is generally true for long hollow products. The full round cross section No. 1 should not be used if 0.394 in. is exceeded.

Reinforcements around the edges are advantageous to avoid stress raisers. They have to be placed properly when designing. Bolstering reinforcements should be on outside (shaded areas Fig. 4).

Gating

The castings to be made by die casting must be provided with a sprue placed in a favorable location. Size of the sprue depends on the volume of the casting and on the type of machine to be used. However, the position of the sprue depends on size and shape of the part so that processing can be facilitated by proper design. The sprue should be so positioned that even that part of the cavity farthest removed is perfectly filled with molten metal.

The sprue for the cover as shown in Fig. 5 must be placed on the side, i.e., outside of the castings, since no openings for gating are available internally. This design can be used easily especially if a divided sprue is used but it is feasible also with the undivided indirect sprue (c). The gating (A) connects the sprue (E) with the die

cavity, and the entering metal first reaches the outer zone (R) of the casting. There is a tendency to design this external zone exceptionally thick walled to make the cover sufficiently rigid. However, this is poor design practice for die casting.

The molten metal first fills the thick-walled rim and thus traps air in the falls of the cover; thickness (S) is not filled completely. To prevent this, the rim of the cover is to be provided with the same wall thickness(S) and if necessary has to be stiffened by ribs, which should not lead to metal concentration.

Yet if a thick-walled rim as in (a) is maintained, the central sprue as in (d) is best; and a pouring hole must be provided.

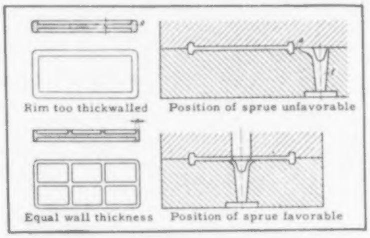


Fig. 5 . . . Shaping of a cover.

Die Casting: COMPETITION

Many parts presently made by other methods can be made more economically by die casting. In many cases this requires a complete redesign of the casting. To evaluate the many advantages of die castings, important points must be considered for the conversion.

Sand-Mold

The relatively high cost of material may, for example, make a change from gray-cast iron to a light-metal die casting more difficult. The decrease in strength due to the reduction in wall thickness must be compensated through proper shaping and rib design.

Conversion of the bearing cover shown in Fig. 1 from gray iron to zinc die casting resulted in about 36 per cent reduction in weight. The wall thickness has been cut from 0.197 to 0.0985 in. while the bottom was stiffened by ribs.

Undercuts cause no difficulty with sand-mold castings since the cores can be shaken out, but undercuts must be eliminated in conversion to die casting. When testing a new part in a die casting metal, sand castings are often used as prototypes for evaluation and to save time. These, likewise, should have no undercuts so that when quantity production is required, the switch to die casting can be accomplished readily with no further design changes.

Redesign of Large Castings

In case of extremely large sand castings, sometimes a division into several smaller die castings is required to simplify the design of the die and to simplify processing as die castings. In addition to the superior surface quality and the dimensional accuracy of die castings, the core and mold wall displacements occurring in sand-mold castings should be mentioned. These, of course, do not occur in die castings. This fact permits better utilization of the available space conditions.

All holes, openings, slots, etc., if possible, should be cast-in if they can be arranged vertically to the die parting plane or in the direction of core or slide pulls. Metal concentration should be kept as small as possible or proper recesses should be provided. The same holds for bosses serving as locations for cored holes, since the displacement tolerances conventional with sand castings often require some over-dimensioning. This definitely should be avoided in die castings.

Figure 2 shows sand-mold castings on the left and the redesigned die castings on the right. Some important advantages exist, such as casting of holes, slots, and bolts. In addition, various measures are taken to obtain uniform wall thickness throughout all sections of the casting.

Permanent Mold

A change-over from permanent mold to die casting is rare, because both methods have proved to be of special advantage for a certain group of castings. To deal with relatively simple medium and thick-walled parts, which also have varying wall thicknesses and undercuts, permanent mold castings are preferable. The cast structure obtained with sand-mold and permanent mold castings is generally more uniform than that of die castings.

For this reason pressure-type vessels with large wall thicknesses are usually made by one of these two methods. Change-over to die casting results in saving on machining costs.

Selection of the proper casting

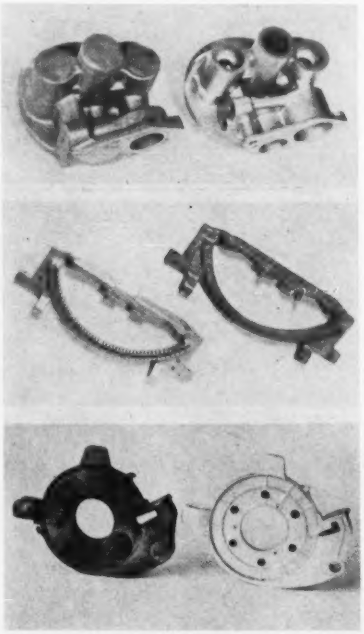


Fig. 1 . . . Conversions from green sand to die castings.

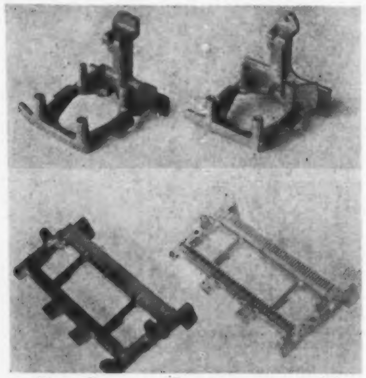


Fig. 2 . . . Permanent mold castings on left replaced by die castings at lower cost.

process to be used for making a certain part may depend on the number of parts to be made. If less than 500 parts must be processed, the permanent mold casting is usually more favorable from the viewpoint of manufacturing costs. The surface quality of permanent mold castings is not as good as that of die-cast parts. Therefore, the former requires larger machining allowances on surfaces which must be accurate, whereas, in the case of die castings, such locations can be precision cast.

Figure 3 shows several parts which have been changed over from permanent mold to die casting. Looking at the fitting in the upper part of Fig. 3, one can see

Fig. 3 . . . Pump housing, left, made by die casting; and by permanent mold, on the right.

Fig. 4 . . . Parts previously forged now made by die cast.

the undercut of the raised projection inherent to the permanent mold casting has been eliminated by removal of the rim around the base plate (lateral slide in the die).

Manufacture of the oil pump housing (Fig. 4) as a die casting makes possible casting—in the oil grooves. Space required for the gear can be cast accurately to size if a Zn-base or Mg-base alloy is used and if usual die-casting tolerances are satisfactory. Cored holes for the threads are cast so that the thread may be tapped without a root drill.

Forging

Since pressed or forged components are usually subjected to very high stresses, change over to die casting from forging is possible only in some individual cases. Before the actual change over, a strength test should be performed by using a similar casting that has been processed as a die casting. However, there are a number of forgings, especially those made of light metals and copper-base alloys, which may be produced as die castings without restrictions.

Parts for armatures, knobs, covers, contact levers, etc., can be changed over as illustrated in Fig. 5. This usually saves a substantial amount of material which is transformed into chips when machining the forging. Holes and other cavities can likewise be cast-in. Die-cast parts are usually cheaper than hot-forged parts because the initial material for the forging is already a semi-finished product, whereas in die casting the raw material is transformed into a casting in one operation.

Often, extensive redesign of the forged part is necessary since the design of a die casting is more flexible by using cores and core slides in the die.

The often thick-walled sections of forgings, especially for hollow parts, must be adjusted to die casting practice by arranging of recesses and ribs.

Copper-base alloy die castings have replaced many parts that previously were hot forged since mass production makes the former method more economical. Mechanical properties and the machinability, however, for parts made by die casting methods are not as good as those of forged products.

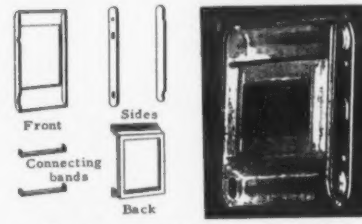


Fig. 5 . . . Casting in one piece results in lower production cost.

Assembled Part

The great advantage of die casting is that parts that must be assembled from a number of individual components, while using other processing methods, bring savings in material, weight, machining, and assembly costs when combined into one single part.

The camera housing was previously assembled from six punched and bent parts and welded together. The die-cast construction in one piece is more rigid, has a cleaner appearance and a much lower weight than the sheet construction. An exact calculation shows that production of a magnesium die casting was proved to be about 20 per cent cheaper. The die costs for the die casting were also less than those for the many punching and bending tools needed for the manufacture of the individual parts.

Actually, change-overs made of assembled parts to die castings demonstrate repeatedly the important advantages that result. By elimination of many single parts and a considerable reduction of assembly costs, the much simpler die-cast construction can be accomplished with savings up to 55 per cent.

The aforementioned examples show that, when a change over to die casting is made, screw, rivet, or welded connections are replaced by connecting ribs or walls. Rib construction leads to improved rigidity of the die casting as compared to sheet metal parts.

George W. Cannon, Sr. / *Muskegon, Mich.*

FIAT: symbol of Itay's industrial progress and source of significant advances in metalcasting techniques

FIAT convertible is the 1958 descendant of a world-famous line.

Leadership is the foundation upon which the great FIAT organization of Turin, Italy, has built its success. The company's first fame was won by its big red race cars that began campaigning soon after the firm was organized in 1899. Continued leadership in engineering and in the adoption of advanced production methods has increased the prestige of the firm as a world leader in the production of engines and vehicles.

Today, FIAT builds automobiles, trucks, buses, and tractors; diesel engines for marine, rail, and automotive application; aircraft engines; and jet aircraft. Over 70,000 people are employed in the production of these products.

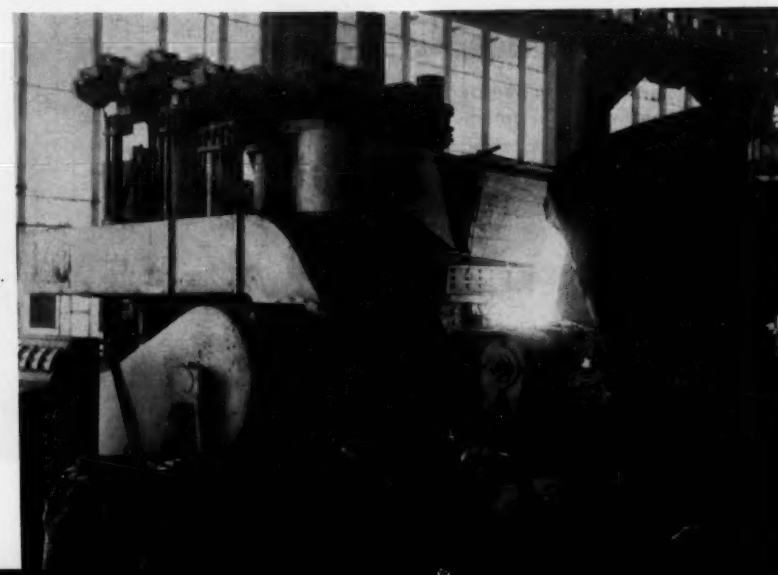
Gray iron, malleable iron, and aluminum castings for these products are furnished by the FIAT foundry. The foundry is currently melting 200-230 tons/day of iron. This metal yields about 130 tons of castings each day. Ten per cent of the iron tonnage is malleable iron. Aluminum is melted at the rate of 55-60 tons/day, and the yield is about 45 tons of castings daily.

Castings are produced in sand molds, permanent molds, and by die casting.

The photographs on these pages will take the reader on a tour of the major areas of the FIAT foundry. A study of these production techniques should prove valuable because much of the equipment is of North American manufacture.

"Triplex" melting uses a series of three electric furnaces: 1) iron is melted in 15 ton direct arc Brown-Boreri furnace, 2) transferred to smaller 10 ton arc refining furnace, 3) held in 8 ton induction unit.

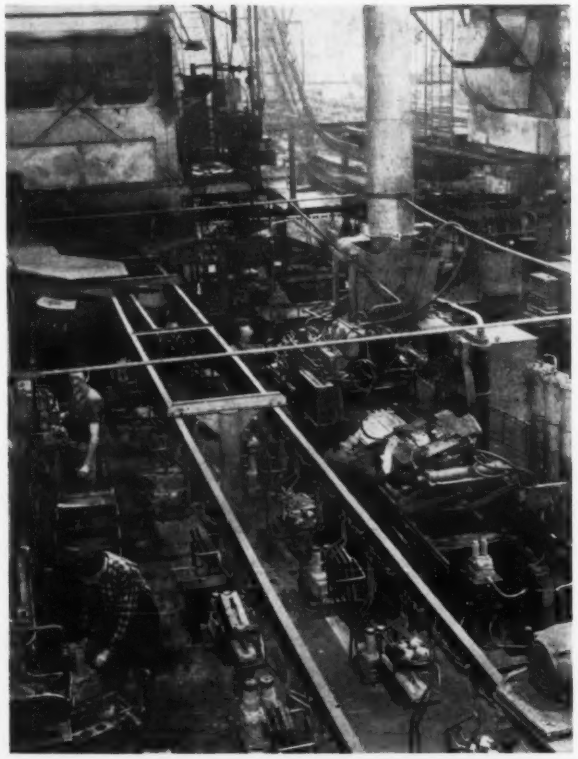
Molten iron is being transferred to the refining furnace. Melting department has capacity of 230 tons per day, including some malleable iron. Raw materials include iron borings from FIAT machine shops.



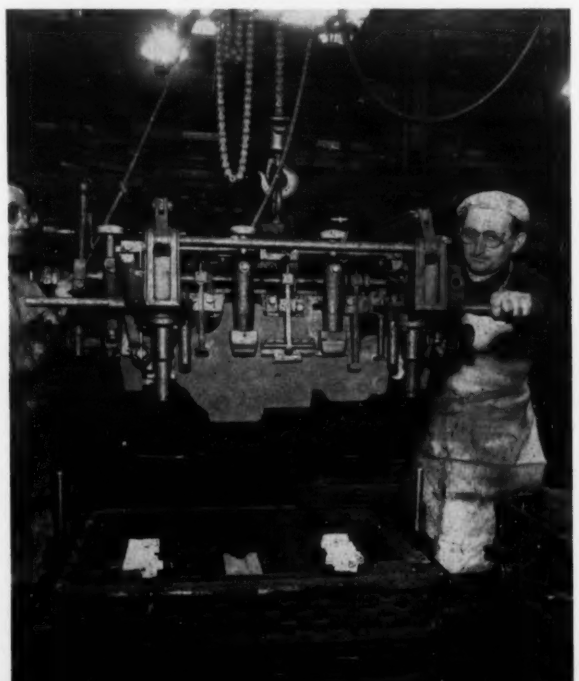
Semiautomated mullers handle 880 lb batches in 1.2 min cycle.

Four-station merry-go-round with slinger makes truck part molds.

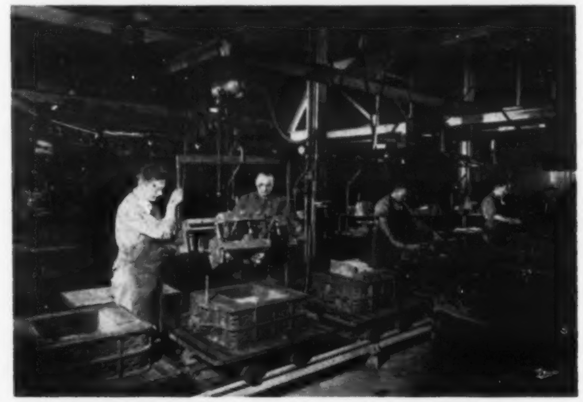
Cylinder barrel cores move by belt in finishing department.



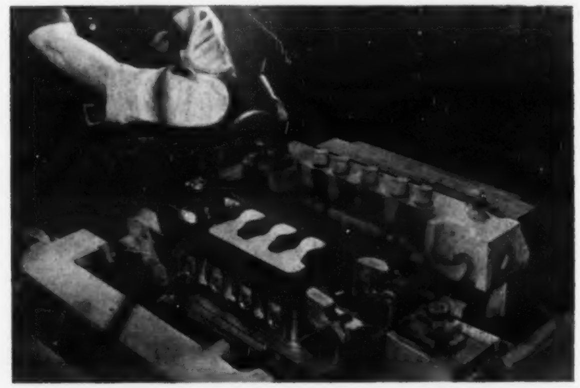
Cylinder-barrel cores are blown and drawn on this mechanized line at a 180 cores/hr rate.



Special core setting fixture is used to lift and locate core assembly in cylinder mold.



Engine-block cores are set with aid of fixture.



Aluminum car heads cast 10/hr in permanent mold.

Aluminum gearboxes are die cast at 18/hr rate.

Ladles of iron from the melting department are placed on four-wheeled platforms that move on rails. Two men at the cylinder block pouring station prepare ladles and pour molds with aid of overhead monorail.

Molds come out of cooling tunnel on casting loop. Four men handle shakeout with vibrating equipment. Castings drop to underground belt.

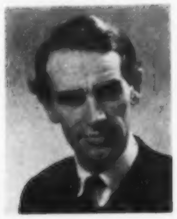
Self dumping tote-boxes handled by fork lift trucks speed moving of castings from underground conveyor to gravity feed hoppers at grinders.

Fumes collector and floor grating improve working conditions. Pouring rate is 66 molds/hr.

After grinding side faces and shot blasting, cylinder blocks are transferred to apron conveyor where they are cleaned with pneumatic chisels.

Both metal patterns and permanent molds are made in metal pattern shop.

Aluminum castings tracing section maintains dimensional quality control.



Arthur Woods / *European Mgr.*
Shallway International Corp.
Palo Alto, Cal.

Know how process differs from green sand practices to get most from shell

STOP-LOOK-LISTEN BEFORE YOU TRY SHELL MOLDING

Fig. 1 . . . Well-planned shell.

Foundries in this country using shell molding can benefit materially from the European experiences in designing pattern plates, gating and risering, curing, joining, coremaking, as well as stack molding.

Shell mold casting can offer as main advantages, superior finish and accuracies, reduction in weight, reduction in machining costs and frequently over-all reduction in production costs. It is still advisable for the founder who is about to embark on the making of shell molded castings to carefully consider a number of problems that are not apparent until one is in the middle of them.

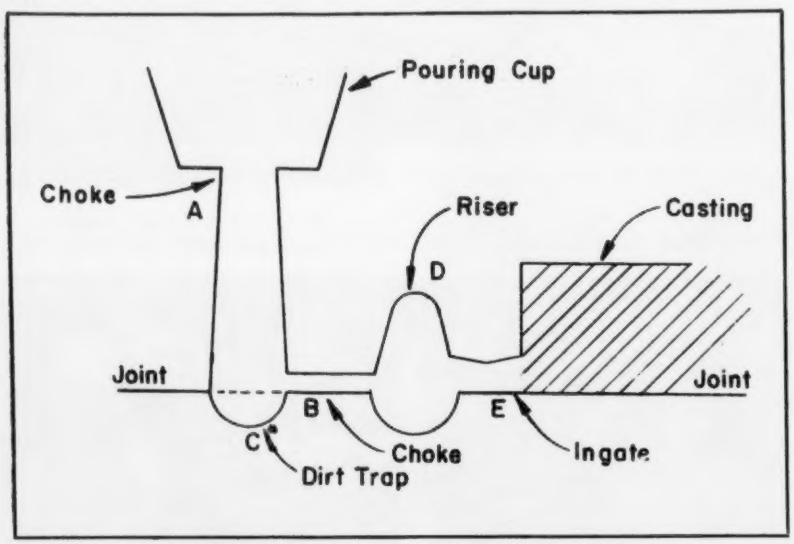


Fig. 2 . . . Horizontal pouring preferred with this gating.

Planning Pattern Plates

The ultimate design of a pattern plate can rarely be the prerogative of a single individual unless he be that rare character who combines the skill of the patternmaker, the molding experience of the foundry foreman, and the applied knowledge of the metallurgist. The training of all three has its part to play in putting an efficient pattern plate into production.

At least the following factors must be determined:—

- The method of jointing the pattern and cores involved.
- The number of castings required from the pattern.
- The general method of pattern manufacture.
- The number of patterns to be mounted on a plate.
- The method of gating and of feeding.
- The space to be left between patterns and around the edge of the plate for the application of mold glue.
- The number and position of ejector pins.

All these factors are worthy of greater discussion than possible to cover in this article, but some points of view on three of them will be of interest and practical assistance.

Number of patterns mounted on a plate. Two opinions are invariably in conflict when considering this factor. On the one hand the cost accountant visualizes as large a number of castings per mold as theoretically possible.

On the other hand the foundryman knows it is necessary to leave adequate space for a good gating and feeding system, sufficient room between patterns for the application of adhesive, and space for ejector pins. Overcrowding of the pattern plate is by no means the least cause of scrap within the shell molding foundry.

The number and positions of

ejector pins. The number of ejector pins used will be the minimum commensurate with obtaining good ejection and continuous working of the plate. Proper positioning will provide symmetrical and simultaneous shell ejection. Two major faults associated with bad ejection are: warpage of the shell due to uneven thrusts at different places on the plate and cracking of the shell.

In the first consideration of an ejection system it is always desirable that a pin be placed in each corner of the plate about 1/8-in. from edges. The remaining pin locations depend mostly on the shape of the pattern. Shapes curving in the plane vertical to the surface of the pattern plate require few pins because the taper is very great. Shallow patterns up to about 1 in. high do not need many pins, but taller patterns require more. In those cases the pins need to be at no greater distance than 1/2-in. from the pattern.

Lastly, the founder would be wise to check on the exactness of ejector pin length and the diameter and shape of the ejector pin heads. Fig. 1 shows a typical symmetrical layout of an ejector system (curved indentations are made by head of ejector pins).

Gating and Feeding

There is probably no subject about which more has been written, and written about in vain, than gating practice. In shell molding all too often bad gating practice has meant not bad castings but scrap castings.

I would warn and advise those metalcasting plants about to embark on shell molding to take due heed of the experiences of those who have put their shell molding gating practice into writing.

Shell molds differ from sand molds in four vital ways:

- They are perfectly dry and the initial chilling effect on the molten metal is greatly reduced.
- The frictional resistance offered to the flow of metal is lower due to the smoothness of the shell.
- The high permeability of the shell prevents the normal back pressure from retarding the entry of the metal into the mold; thus, the metal flows more freely than in sand molds, and its velocity through the running system is high.
- The smooth skin fails to trap dross and slag necessitating the inclusion of efficient dirt traps in the runner system.

Governing this extreme velocity of the molten metal is one of the main tasks in gating practice. In a green sand mold 2 lb of iron will pass through a one square-inch ingate in one second using 7 in. head of metal; using the same dimension in a shell mold, the flow rate is nearly 100 per cent greater.

High velocity causes mold erosion, turbulence, and the creation of hot spots, particularly when the stream of metal directly encounters a core. Velocity into mold cavity may be reduced by decreasing the size of runner system and casting horizontally wherever possible. There is danger in reducing the sizes of gates because reducing the flow speed increases the pressures in the system. This can cause metal to spurt into the mold instead of flowing quietly. Quiet flow may be achieved by having the total cross-sectional area of the in-gates slightly greater than the cross-sectional area of the runner.

Horizontal Casting

Horizontal casting also reduces metal velocity because it allows a great reduction in head height of the metal. The hydrostatic pressure is also lower, permitting the casting of unsupported molds which previously required back-up material to prevent them from bursting. This is not to say that all shell molds should be cast horizontally. Experience has shown, for example, that air-cooled cylinders, for soundness and running the thin fins, should be cast vertically.

Figure 2 illustrates a runner system which has proven highly successful when applied to the average type of shell molded castings. The design of this system fulfills three requirements: During pouring the system is always full and, therefore, under constant pressure as the result of chokes at B & E; velocity is reduced by the dirt trap at C and the riser at D; the blind riser at D provides adequate feeding for the casting. The design of the in-gate at E is interesting; first it narrows to allow a breaking off point; then it expands to prevent metal spurting into the mold and causing turbulence.

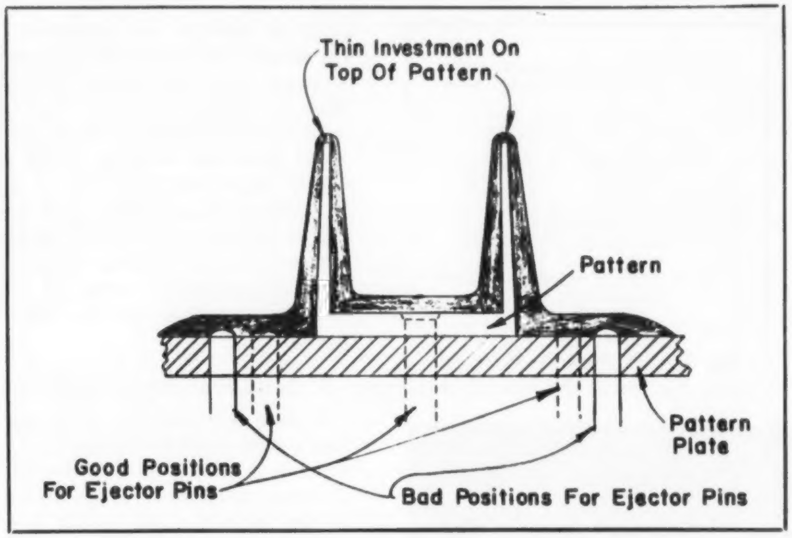


Fig. 3 . . . Proper position of pins will stop cracking of shell.

Cracking of Shell Molds

Cracking can take place at any one of the following three stages in the manufacture or use of the shell:

During ejection of shell from pattern. Usually caused by a badly positioned ejector pin, insufficient ejector pins or pins which have dropped away from the plate as it was inverted (due to weak springs), and trapping sand underneath the pin-heads.

A typical example of how such cracking could take place is shown in Fig. 3. The investment over the top point of the pattern is thin because, being remote from the pattern plate, it tends to lose heat. Hence, unless the upward thrust is placed as near to the vertical side of the pattern as practical (shown by the dotted pins), a small, almost indiscernible crack may appear in the thin top of the shell. An additional ejector pin placed in the unsupported center as part of the pattern would help solve this problem.

During the closing of shells when using the vacuum method of closing. In this system a mold is placed between two rubber diaphragms and the air exhausted by a vacuum pump. Cracking difficulties arise when joining shells with a hollow section as depicted in Fig. 4. The force exerted against the shell is sufficient to crack or even smash shell to fragments. This damage can be prevented by placing a metal or wood container over the shell so that atmospheric force exerted on the unsupported part is absorbed by the container.

During or after the casting of the mold. By far the most common source of mold cracking is caused by two conditions: a) poor curing conditions in the molding machine and b) excessively thick shells into which aluminum has been cast.

Poor curing conditions occur when only a source of heat above the pattern plate directs heat to top side of shell and no internal

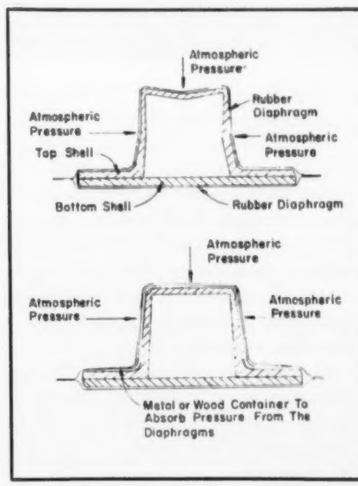


Fig. 4 . . . Rubber diaphragm and vacuum used to fuse shells in vacuum closing method.

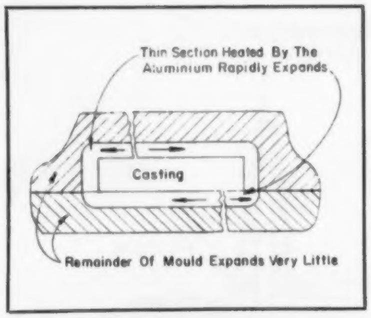


Fig. 5 . . . Difference in expansion may cause shells to crack.

Fig. 6 . . . Vacuum device used for the joining of mold halves.

heating elements are built into plate to provide heat for inner surface of the shell. This heat not only has to cure the shell but also penetrate to the pattern beneath in order to restore its temperature, lowered during the investment period.

In order to penetrate to the pattern the mold is heated excessively high; part of the resin is burned out, leaving the mold in a low state of strength.

This problem may be solved by providing a balanced system of curing with electric heaters placed immediately beneath the pattern plate to provide 35 per cent of the total heat, leaving 65 per cent to come from the curing oven. If 20 watts of heat are provided for each square inch of pattern plate area, then an average mold of 1/4-in. thickness will cure in 40-50 seconds. Even under good curing conditions, over-cured molds, whether due to excessive temperatures or prolonged curing at correct temperatures, will be low in strength.

Excessively Thick Molds

It may seem strange to suggest that a thick mold could crack when filled with aluminum. In the case of a thin aluminum casting, as soon as the mold is filled, a thin layer of mold adjacent to the rapidly cooling metal becomes almost as hot as the metal. The temperature of molten aluminum being fairly low prevents a fast, even heating of the complete mass of the mold.

As a result, the thin, hot layer next to the casting tries to expand against the thicker, external layer which remains comparatively immobile.

The resultant internal stress causes a crack. Fig. 5 illustrates how this happens. The fact that this layer next to the casting only heats to about 1076 F makes matters worse because at this temperature silica suffers a sudden allotropic expansion of 0.4 per cent. The cure or partial cure of this condition is to maintain the shells as thin as possible or heat the molds to approximately 480 F before casting.

Joining Molds

Only those two methods which are most widely used for joining shells will be discussed. These are: pressing together a pair of shells by means of rubber diaphragms exhausted by a vacuum pump, and the pressing together of shells by the external application of air pressure, applied to the shells through steel pins from the top and the bottom. In each case the pressure is maintained until the adhesive between the shells has hardened under the latent heat in either one or both of them.

Joining by vacuum. This technique enables molds to be assembled at the rate of about one every minute, thus greatly improving on the previous tedious task of securing the shells together by nuts and bolts. In vacuum closing, a paste which sets hard under the effect of heat within 15-20 seconds is placed around the joint of the hot mold.

The two shells are placed together and pressed tightly against one another by the force exerted by two rubber diaphragms in which they are contained and from which the air has been quickly exhausted by a vacuum pump. With the evacuation of the air the diaphragms are forced against the shells by the pressure of the atmosphere. Pressure is maintained until the glue has set under the latent heat contained in the shells.

Figure 6 shows a mold under pressure in a vacuum-type fuser. The great advantage of this system is that the diaphragms mold themselves to the shape of the shell and pressure is applied evenly all over. Vacuum fusing is not generally applicable to molds of excessive depth or to molds for large hollow castings. Despite these exceptions, however, vacuum-type fusing is the cheapest method of assembling shells and is to be highly recommended.

Joining by steel pin pressure. This varies from the vacuum system in that the shells are pressed together by two sets of steel pins—one pressing downward on the top shell, the other set pressing upward against the bottom shell. The bottom set is stationary whereas the top set is propelled downwards by an air-operated piston.

Figure 7 shows a mold in a pin-type shell fuser. When any two pins meet, they must be in line; otherwise a sheer force will be set up between them and the mold will break at that point.

This is avoided by drilling both plates clamped together. The guide pillars upon which the top plate descends must be absolutely parallel. The pin-type fuser is superior to the vacuum-type fuser for joining shell molds that have deep draws.

Shell Cores

In spite of a later start the applications of shell cores have overtaken that of shell molds. Any core below a solid weight of 30 lb may be considered a possibility for making as a shell core provided that the equipment is available to handle the core boxes.

The grounds on which a metalcaster decides to utilize shell cores are numerous but may include: accuracy to reduce internal machining, collapsibility to reduce knockout problems, elimination of core

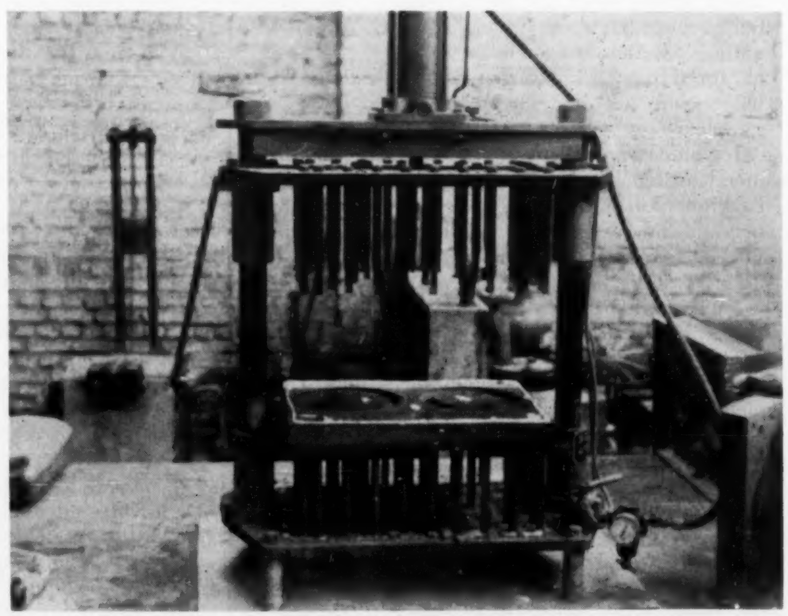


Fig. 7 . . . Pin-type shell fuser is best for deep draw molds.

driers and core ovens, and a marked reduction in material expenditure, since reduction of core weight may be as high as 80 per cent. This last advantage will ultimately be responsible for the appearance of shell cores in almost every foundry where the quantity of cores justifies the employment of metal core boxes.

A typical large shell core used in the automotive industry indicates what is meant by saving in material expenditure. From an oil-sand weight of about 10 lb, its weight as a shell core is reduced to 1 lb. Material cost as a solid core is about three times that of a shell core. This comparison is based on conventional sand core mixtures and a resin-coated shell core mixture containing 3 per cent resin and 97 per cent sand.

Since the cost of the shell core mixture is nearly three times that of the conventional mix, you can form the rough rule that when a core can be reduced to less than one-third of its weight by making it as a shell then that core will be cheaper from the standpoint of material costs. Large cores made as a shell will withstand casting pressures and are doing so every day by the thousands.

Stack Molding

It is not generally known that existing shell core blowers can be utilized to blow certain types of molds which can be stacked vertically for casting. Castings with shallow sections such as permanent magnets and piston rings lend themselves to stack molding. Half patterns are mounted on each core box half. The blown core is double sided with the impression of the half pattern on each side. These cores are then stacked vertically so that the half cavities come together to form a complete cavity. The runner system is also included in the core.

Figure 8 shows how molds produced in a shell core blower are stacked to produce cast piston rings. The section through the core box shows one large ring, but this could be a dozen or more, dependent on the size of the core box. Both the in-gate and down-sprue are included in the core so that when they are stacked, the sprues are continuous from top to bottom.

What is the advantage of blowing such molds instead of dumping them in the normal manner? First, more patterns can be grouped in the same area because less space is devoted to ejector pins and to accommodation for paste application. This means that the molding material cost per casting is less.

Second, the rate of castings' output is greater for the same area of mold. For example, in the case of a 3 1/2-in. piston ring, each blown mold of size 20x12 in. makes 15 rings. Whereas the same size dumped mold would contain only 10 rings at the most. Rate of mold production would be about the same in each case.

Third, the operation of mold joining is simpler. As each core is made, it is placed immediately into a vertical casting attachment holding about 10 molds, with a clamping device on the top. This stack of molds is self-supporting, with little danger of mold bursting. Fourth, the floor space occupied for casting is considerably smaller.

Piston rings and permanent magnets are good items for shell molding. In the case of piston rings, the first two machining operations can usually be eliminated. These are rough cuts to reduce the height of the ring. Two light cuts are necessary as the casting is in a brittle state caused by rapid cooling in a green sand mold. The slower cooling within a shell mold makes the rings less brittle and easier to handle. Reduction in machining costs alone justifies the application of shell molding to the manufacturer of piston rings.

Permanent magnets are cast in hundreds of thousands by shell molding for the following reasons. The tungsten cobalt copper alloys used are very expensive; through shell molding it is possible to improve the yield of good castings by 10 to 20 per cent. The accuracy of a shell mold permits not only savings in an expensive grinding operation but saves the removal of an expensive metal which is not easy to reclaim after it has been ground away.

Conclusions

Shell cores may be used to advantage in the manufacture of such castings as water fittings, globe valves and gate valves to pass liquids of various sorts, malleable iron fittings, automotive parts, sanitary fittings, and many other castings.

It is to be hoped that the author has contributed to the more specific rather than general knowledge of shell molds and shell cores. The forecasting of the immediate future is always interesting even if dangerous and is important in proportion to the accuracy of the forecast. As the author sees it, the phases of basic experimentation are passed; development continues — development which may in a few years render today's methods almost unrecognizable.

A good guide as to production can be obtained from the study of the estimated monthly resin sales in Europe. The author assesses the present monthly consumption of resin in Europe as exceeding 350 tons. Within the next five years this usage should reach 700 tons per month. Importance of resin-coated sand both economically and commercially is gaining recognition.

The next three years should see the virtual disappearance of the conventional mixtures of dry sand and powdered resin. Coated sand holds the key to wide-spread use

Continued on page 54

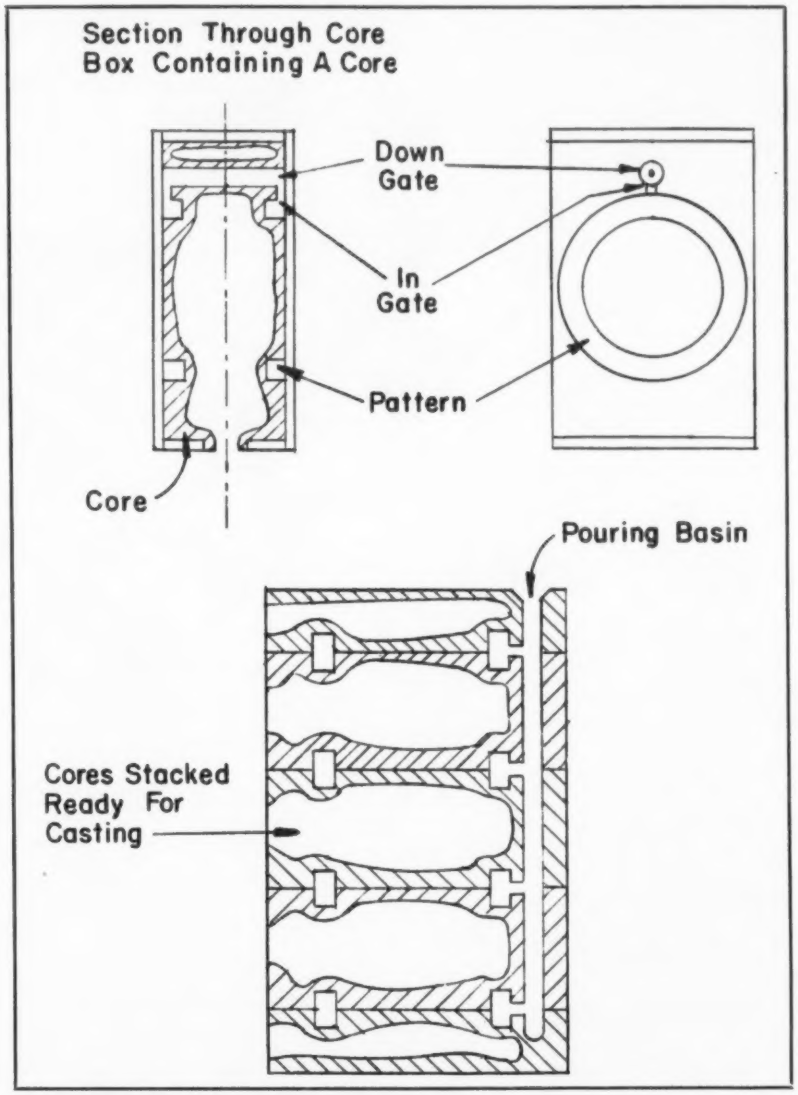


Fig. 8 . . . Shells made in core blower for use in stack molding.

Shell Molding

Continued from page 53

of shell molding in the next phase of production. Its ability to make significant reductions in the quantity of resin used per ton of castings produced will broaden the field in which shell molding can be economically employed and should lead to the installation of more mechanized or semi-mechanized shell molding foundries.

The author has always maintained a personal belief that the widespread usage of the process is dependent on its degree of acceptance by the automotive foundries. In the design of the conventional water-cooled piston engine, application has been virtually limited to shell cores. However, tremendous efforts are being made by the car manufacturers to establish the gas turbine engine as a production reality. This engine, containing many steel and nodular iron castings, may require shell molding as the means to mass production.

Shell molding has proven its ability to reduce costs where the more expensive and obdurate metals are concerned by reducing machining allowances and increasing the yield of castings by lowering the weight of runners and risers.

A.S.T.M. Releases Books

■ A compilation of 370 references to articles published in 1956 dealing with the fatigue of structures and materials has been issued by the American Society for Testing Materials. An abstract of most references is included in the 68-p publication. Individual references may be put on filing cards.

A second publication is "Compilation of Chemical Compositions and Rupture Strengths of Super-Strength Alloys," 6 pp. This lists the name, nominal composition, characteristic rupture strengths for rupture in 100 and 1000 hours, and patentee for approximately 150 domestic and 75 foreign alloys. The compilation includes the ferritic (martensitic) alloys and age-hardening steels. It does not include the conventional austenitic stainless steels.

Both may be purchased through the Society's headquarters, 1916 Race St., Philadelphia 3.

new books

Typical Microstructures of Cast Metals . . G. Lambert (ed.) 224 p. The Institute of British Foundrymen, St. John St. Chambers, Deansgate, Manchester 3, England. 1954. 84 shillings.

An extensive and thorough correlation of cast metal microstructures with their physical properties, this book appropriately starts off with a chapter devoted to preparation of specimens for microscopic examination. Sampling, mounting, grinding, abrasive smoothing, polishing, and etching procedures are fully discussed. Preparation of the various etching solutions for ferrous and non-ferrous alloys are detailed.

Approximately 300 top quality photomicrographs are reproduced with remarkable clarity. Magnification and etchant appear under each picture. Many structures are shown in both the unetched and etched condition. In every case, the page facing the photomicrograph lists for each alloy: British standard, common name, grade, specifications, chemical composition, mechanical properties, and explanation of microstructure.

Since microstructures have no language barrier, this encyclopedia of cast metal microstructures should receive extensive world-wide usage as a reference and guide to better understanding of cast metals. A complete index is included.

Manufacturing Processes (4th ed.) . . Myron L. Begeman. 612 pp. John Wiley & Sons, Inc., 440 Fourth Ave., New York, 1957. $8.

Every chapter has been rewritten for this new edition. It is less descriptive than previous editions and places greater stress on principles and materials. Advantages and disadvantages of the various processes are examined.

New topics discussed include electroforming, metal coating processes, electrospark machining, ultrasonic machining, chem-milling, and automation. Of the 25 chapters, four deal specifically with foundry equipment and methods.

Boron, Calcium, Columbium, and Zirconium in Iron and Steel . . R. A. Grange, F. J. Shortsleeve, D. C. Hilty, W. O. Binder, G. T. Motock, and C. M. Offenhauer. 533 pp. John Wiley & Sons, Inc., 440 Fourth Ave., New York, 1957. $14.

This volume is a collection of four separate monographs on elements used as alloying metals with iron and steel: boron, calcium, columbium (plus tantalum), and zirconium. The monographs, written by authorities in the field, contain all the scattered published and unpublished data on these alloying metals. Each monograph has a separate bibliography and name index.

Circle No. 149, Page 7-8

let's get personal

The Caterpillar Tractor Co. has announced five executive changes at their Peoria, Ill., plant. **Gordon Swardenski** has been appointed assistant plant manager. **Charles E. Verkler** succeeds Mr. Swardenski as manufacturing manager.

Mr. Verkler's former position as assistant manufacturing manager is being filled by **Robert E. Gilmore. Thomas H. Spencer,** Peoria plant metallurgist since 1955 heads a new quality control department. His former assistant **A. L. Jerome** succeeds him as plant metallurgist.

Frederic S. Claghorn was recently appointed vice-president in charge of the Fletcher Foundry Div., Fletcher Works, Inc., Philadelphia. He has named **Edward Oliver** as superintendent of the foundry.

Warren M. Spear . . staff metallurgist of Worthington Corp., Harrison, N. J., has been elected chairman of the AFS Gray Iron Division Effect of Temperatures on Properties of Cast Iron (5-H) Committee.

David T. Morgenthaler . . has been named president of Foundry Services, Inc., Columbus, Ohio. He was formerly vice-president of Delavan Mfg. Co., Des Moines, Iowa. A specialist in industrial marketing, Mr. Morgenthaler holds B.S. and M.S. degrees in mechanical engineering from M.I.T. **Eric Weiss,** former president of Foundry Services, continues as chairman of the board.

Lyle L. Clark . . has been appointed manager of the Fansteel Metallurgical Corp., tantalum-columbium plant now under construction near Muskogee, Okla. Mr. Clark was formerly with Armour Research Foundation of Illinois Institute of Technology as supervisor of foundry research.

Thomas E. Johnson . . has been named chief metallurgist for Stainless Foundry & Engineering, Inc., Milwaukee. He was formerly foundry metallurgist at Fairbanks-Morse Co., Beloit, Wis., and had been vice-president and general manager of Illium Corp., a firm since purchased by Stainless Foundry & Engineering.

Richard H. Thompson . . has been appointed manager of foundry sales for Climax Molybdenum Co., New York. He was formerly foundry sales manager for American Car and Foundry Div., ACF Industries Inc., and senior metallurgist for that firm.

W. R. Jaeschke . . consulting metallurgical engineer, Whiting Corp., completed a speaking tour of six western AFS chapters. He addressed the Southern California, Northern California, Oregon, Washington, British Columbia, and Utah chapters.

Alan G. Linley . . plant metallurgist, L.F.M. Div., Rockwell Mfg. Co., Atchison, Kans., has been named chairman of the AFS Sand Division Physical Properties of Steel Foundry Sands at Elevated Temperatures Committee (8-L).

Arnold J. Martin . . has been named vice-president of Samuel Greenfield Co., Inc., Buffalo, N. Y. Formerly manager of sales and advertising, Mr. Martin has been associated with this firm since 1946. Prior to joining them he worked on the Manhattan Project of the A.E.C. for the Linde Co.

Erwin H. Albrecht . . has joined Carpenter Brothers, Inc., Milwaukee, as a sales engineer and foundry consultant. He was formerly general foundry superintendent of Blackmer Pump Co., Grand Rapids, Mich., and was chairman of the AFS Western Michigan Chapter, 1956-57.

S. L. Gertsman . . chief of the Physical Metallurgical Division, Department of Mines and Surveys, Ottawa, received the first Award of Merit of the Steel Castings Institute of Canada.

Richard F. Schaffer . . has been named chief metallurgist of Denver Div., Gardner-Denver Co., Quincy, Ill.

obituaries

Arthur H. Stenzel, 71, retired owner of Stenzel Pattern Works, Houston, Texas, died July 31.

A native of San Antonio, where his father had been a patternmaker, Mr. Stenzel moved to Houston in 1909 and opened one of the first pattern shops in that city. He retired in 1952 because of illness. He had been active for many years in AFS, serving on the executive committee of the Pattern Division 1944-1950.

A. H. Stentzel

Horace W. Merriman, 78, formerly in charge of the Philadelphia sales office of Alan Wood Steel Co., Conshohocken, Pa., died Oct. 18. Mr. Merriman was a member of the Steel Club of Philadelphia. He was associated with the company over twenty years.

Dr. Paul Dyer Merica, 68, retired president of The International Nickel Co. of Canada, Ltd., died Oct. 20.

Born in Warsaw, Ind., he received an A.B. degree from the University of Wisconsin and a Ph.D. degree in 1914 from the University of Berlin.

Long identified with research activities of the International Nickel Co. in Canada and the United States, Dr. Merica was awarded many medals for his contributions to metallurgy, among them the Institute of Metals Medal and the American Society for Metals Gold Medal.

Mr. Merica received honorary D.Sc. degrees from De Pauw University, Lehigh University and Stevens Institute of Technology. He was a member of National Academy of Sciences, American Iron and Steel Institute, American Society for Testing Materials, and Canadian Institute of Mining & Metallurgy.

foundry trade news

National Air Conveyor Corp. . . Chicago, a new, wholly owned subsidiary has just been announced by the National Engineering Co. The new firm will engage in designing, engineering, and manufacturing of pneumatic conveying equipment for transport of bonded materials in the foundry. Decision to enter this field was based on the acquisition of existing patents, improved equipment, extension of mechanical sand handling services and equipment, and past experience with such systems.

Unique features of this pneumatic equipment are: the elimination of down time through the use of a bilateral valve and two transporters capable of delivering sand to two points at the same time; switches and diversion valves; positive alignment featuring less maintenance and easier replacement of baffles in box receiver.

B. L. Simpson is president, R. L. McIlvaine, executive vice president, and J. L. Kaufman, chief engineer, of the National Air Conveyor Corp.

Draper Corp. . . Hopedale, Mass., world's largest manufacturer of automatic looms for the textile industry, held foundry open house Oct. 8 with service the keynote.

Over 150 industry representatives, including buyers and designers, toured this vast plant in company with 25 selected guides. They saw one of the most highly mechanized foundries in the East covering a 360,000 sq ft area with a potential daily production of cast iron and aluminum close to 400 tons. Of special interest was a new venture, the aluminum foundry, where highest quality metal is produced to meet rigid specifications.

Draper Corporation invited over 150 industry representatives to an open house at its foundry operations.

Visitors were impressed by both the modern methods and their uninterrupted 100 year production record and the close harmony between employers and employees.

One guest who arrived with a loose pattern 20 in. in diameter with the required core boxes was given a quotation for handling his work before leaving the plant. A social hour, dinner and entertainment followed the highly successful tour.

Henry G. Stenberg, foundry superintendent and AFS Director, stated, "This open house was an extension of the idea behind the Castings Congress held biennially by the American Foundrymen's Society."

Draper Corp., Hopedale, Mass., world's largest manufacturer of textile looms.

East Texas Steel Castings Co. . . Longview, Texas established an enviable record of 620,493 man hours in 415 days without a lost time accident. Nine of their ten departments have a total of 605 days with no accidents. H. E. Nance, general manager; Ross Williams, works manager; and E. F. Jacobs, safety director credited this fine safety record to teamwork of their foremen, all the employees, and constant alertness and sense of safety responsibility by every employee individually.

Viewing the results of teamwork with pride: Ross Williams, E. F. Jacobs, W. F. Leonard and H. E. Nance of East Texas Steel Castings Co.

W. F. Leonard, regional director for Information and Public Relations of the Texas Safety Assn. came to the plant and commended the personnel on this outstanding record. He paid tribute to their safety record as one of the finest in Texas industry.

Adirondack Foundries & Steel, Inc. . . Watervliet, N.Y., firm has sold its name and business to Consolidated Foundries & Mfg. Corp., Chicago. The 400 employees of the firm will be retained and production is expected to increase. Consolidated Foundries & Mfg. Corp. now operates 14 foundries in the midwest.

Pettibone Mulliken Corp. . . has announced the establishment of a nation-wide chain of sales offices for its materials handling equipment.

Brush Beryllium Co. . . dedicated a new beryllium metal plant at Elmore, Ohio, on Nov. 18.

American Steel Foundries . . Chicago organization reports net income of $8,008,000 on sales of $123,000,000 in 1957. Net income for 1956 was $8,371,000 on sales of $117,000,000. Unfilled orders amounted to $53,000,000 on Sept. 30. Large capital expenditures are planned for 1958.

National Precision Casting Corp., Paoli, Pa., producers of both ferrous and non-ferrous precision castings, recently moved into a new 27,000 sq ft plant.

The move was part of a half million dollar modernization program to make National Precision one of the largest integrated precision casting firms under one roof in the United States.

Included in the new plant is a complete engineering department, tool and die shop, both plastic and wax departments, six bale-out ovens and two new electric furnaces. National Precision is a subsidiary of the Beryllium Corp., Reading, Pa.

Reynolds Metals Co. . . has released Buick's announcement of the largest production permanent-mold aluminum casting ever used in the automotive industry. This 26-pound aluminum transmission case is the first to combine three formerly separate parts into a single permanent mold casting. Integration of the torque converter housing, gear housing, and valve body into a single poured component is said to be a major break-through in aluminum casting technology.

Robert J. O'Grody, Reynolds automotive sales manager, points out the intricate valve body, heart of Buick's new transmission casting.

Weight savings, economies in tooling, machining, and assembling, dictated the single casting technique which permits multiple operations to be combined into production of a one-piece single transmission case.

Harbison-Walker Refractories Co. . . began shipments from new Hammond plant, which had been under construction since the summer of 1956. The new operation is equipped with the most modern facilities and located to supply basic refractories to the expanding industries of their area.

Bal-Tate Furnace Co. . . . newly-formed Detroit firm has announced production of heating furnaces that use liquid glass as a heating medium.

Designing Steel Valves for High-Pressure Uses

by A. S. GROT / Chief Metallurgist
Edward Valves, Inc.
East Chicago, Ind.

■ Designing a high-pressure steel valve body simply involves the selection of areas to serve as an end effect and the selection of sections to accept the risers. The connection of these two areas with appropriate tapered sections will insure directional solidification and result in shrinkage-free valve body castings.

Proper tapering and directional solidification built into the valve body casting give most consistent results. Tapering of sections is supplemented by external chilling, attempting to use the minimum amount of risers and removable padding. This calls for a close check on the position of heads and gates so that the small amount of extra material added will be correctly used. Internal chilling has not been generally dependable.

Casting Defects

Of the possible casting defects, cavity shrinkage is principally due to design and secondly to heading and gating. Hot tears and cracks arise principally because of inadequate sand practice and because of melting and pouring procedures. Inclusions, such as sand, slag and other non-metallics, are primarily due to gating and pouring and to a lesser degree attributable to the sand practice.

Surface defects such as scabs, rat rails, snotters, and wrinkles are frequently blamed on the sand practice; but more likely gating and pouring practices are the offenders.

Pattern Equipment

Suitable pattern equipment, mounted, headed and gated, is necessary for assurance of reproducing quality in subsequent runs. Detailed records covering mold and core sand mixtures with strict adherence to proven methods are equally important. Quality metal and quality workmanship are two intangibles needed to produce acceptable castings.

High-pressure valve production is characterized by short runs and a variety of castings. Pattern equipment may be made flexible so that it can be altered frequently. Such alterations tend to upset and discourage careful planning. A proven system of gating and risering may be broken up so that only elaborate bookkeeping and careful records will insure a

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return to this setup when the pattern is returned to its original mounting.

Under high labor cost conditions, duplicate patterns may be justified where repetitive types of defects can be eliminated. Offset patterns rapidly pay for themselves in not only reducing labor but also in eliminating surface and subsurface sand and slag inclusions.

Managerial Consultants Aid Ailing Foundries

■ Many iron foundries are closing their doors and being sold for scrap because of lack of managerial "know-how." This fact was brought home to members of the Gray Iron Founders Society, Western New York Chapter in October by Marshall Dyer of Trundle Consultants, Inc., of Cleveland. Foundries that have relied on personal friendships and business acquaintances instead of effective marketing to secure business are finding it "rough going" today.

"Competent consultants offer companies the benefit of experience based on having studied many industrial situations, management problems, and possible solutions, both successful ones and failures."

Mr. Dyer presented a check-list of seven clues as to when a company is in need of outside counsel:

- When a company grows each year in terms of dollar sales but loses ground or barely holds its own within the total growth of its industry.
- When the chief executive officer is unable to leave the affairs of his company for very long in the control of his subordinates.
- When a company cannot purchase new equipment needed to cut expenses and increase profits.
- When, just before pouring-off time in a foundry, people who are working are forced to climb over or under flasks and horses to work.
- When molders and coremakers are forced to stop work about noon or shortly thereafter because there is no more room to lay out molds or cores.
- When more than 30% of the people with whom the president has been doing business for the last 20 or 30 odd years are retiring and being replaced by new faces.
- When you cannot make a change or improvement necessary in your business because the personnel needed do not have the free time over and above their day-to-day duties to accomplish it.

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AFS — Spotlight Focuses on Cleveland — news —

Dedicate Max S. Hayes Trade School, One of Nation's Finest

Cooperation in Cleveland area produces modern facilities

Forty years of participation in industrial education were celebrated in Cleveland Oct. 29 with the dedication of the Max S. Hayes Trade School. The school, built at a cost of almost 3½ million dollars, contains 181,602 sq ft, 34 shops, 30 class rooms, and 3 laboratories.

The building has been designed so that its room walls can be readily expanded or contracted. The shops may be used for several activities if needed.

Program Started in 1917

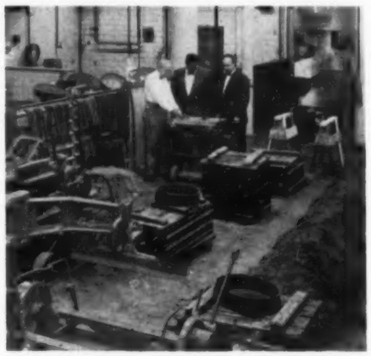
The school is an outgrowth of trade and industrial education started in 1917 as a means of providing skilled

Patternmaking head Cech views blueprints in shop.

workers during World War I. Courses have been added and discontinued to keep pace with the city's industrial activities. Courses in foundry practice and patternmaking were added in 1929.

Expansion during World War II to accommodate war production and G. I. training required occupancy of the West Side branch of the Cleveland Trade School which has become the location of the Max S. Hayes Trade School.

Close cooperation has been maintained between the school and the AFS Northeastern Ohio Chapter. Students and apprentices of the Hayes



Foundry department visited by J. C. Goldie, left, L. H. Durdin, and R. E. Betterley.

trade school participate as junior AFS members. Chapter members have also assisted students in arranging field trips and other activities to assist in broadening their foundry education.

Since the formation of the foundry and patternmaking departments, students have participated in the AFS Robert E. Kennedy Memorial Apprentice Contest.

The students will demonstrate and conduct an operating exhibit at the 1958 AFS Convention to be held May 19-23 at Cleveland.

AFS Men on Faculty

Two faculty members of the school, rated as one of the finest in the United States by the American Vocational Association, are active in AFS activities. Frank C. Cech, former AFS National Director, heads the patternmaking department. James C. Goldie is in charge of the foundry department.

Emil C. Romans, 1st Vice-Chairman of the Northeastern Ohio Chapter, participated in the dedication ceremony. Representing the AFS National Office were Vice-President L. H. Durdin and Training and Research Institute training supervisor Ralph E. Betterley.

Northeastern Ohio Chapter Names Chairman for AFS Convention

Local chapter again assumes role as host to foundrymen

Cleveland for the tenth time becomes host to the annual AFS Convention. No other city has been visited more than nine times since the Conventions were inaugurated in 1896.

Some of the factors considered in selecting Cleveland were the spacious Cleveland Public Auditorium, adequate housing, and the number of representative foundries available for plant visits.

E. J. Romans, General Convention Committee Chairmen and 1st Vice-President of the Northeastern Ohio Chapter has announced the following appointments to local committees:

Honorary Chairman—**F. C. Dost.**

General Committee: **E. C. Jeter,** Chairman; **E. J. Romans,** Executive Chairman.

Ladies Entertainment: **Mrs. E. C. Jeter,** Chairlady; **Mrs. E. J. Romans,** Co-Chairlady; **Mrs. H. E. Heyl,** Registration.

Shop Course Committee: **F. F. Cech,** Chairman.

Plant Visitation Committee: **A. H. Hinton,** Chairman.

Publicity Committee: **R. H. Herrmann,** Chairman.

Banquet Committee: **A. D. Barczak,** Chairman.

Reception Committee: **L. T. Crosby,** Chairman.

Chapter Day Committee: **N. J. Stickney,** Chairman.

Liaison Officer: **H. R. Strater.**

F. J. Dost

E. C. Jeter

E. J. Romans

Talk on Water-Cooled Cupolas Presented to Northeastern Ohio

A discussion of the externally water-cooled cupola at the October meeting attracted more than 200 members.

Harvey E. Henderson, Lynchburg Foundry Co., outlined the development of the water-cooled cupola at Lynchburg. Excellent performance was reported on the water-cooled, hot blast, protruding tuyere cupolas which have operated continuously since July, 1954 in the company's shell-molding foundry. They have been able to melt nodular iron at temperatures in excess of 2950 F, reaching a maximum of 3050 F, operating 12 hours continuously. The cupolas melt about 10 tons hourly.

On melting, the iron remains consistent in analysis with practically no silicon loss. The average coke consumption is about 75 per cent that of conventional, cold blast cupolas. About 60 per cent as much flux is required.

Prior to the technical presentation, A. H. Hinton, 2d vice chairman and educational chairman, discussed the chapter's participation in a television show over a Cleveland station. Chapter educational programs in 1956 and 1957 were reported as highly successful and similar programs are planned for the 1958 AFS Convention.

Charles Jelinek, membership chairman, announced that prizes would be awarded to the committee member who signs the most new members and to the highest ranking non-committee member.—*Jack C. Miske.*

AFS news

Heavy Demand for Exhibit Space Indicates Sell Out for AFS Show

Wide range of subjects shown by technical papers received

A complete sell out of space for the 1958 AFS Foundry Show appears likely. Heavy demands for space during the opening weeks have been made by leading foreign and domestic manufacturers and suppliers. More than 100 leading exhibitors have been assigned space, and over 225 other applications have been received. Space assignments to these are being made carefully to provide a well-balanced floor-plan.

Considerable space is still available, AFS Exhibit Manager William N. Davis points out. However, the unusually high number of requests for space puts the 1958 Foundry Show several weeks ahead of previous exhibits.

Areas of operational interest have been designated throughout all halls to insure a steady flow of visitors to all booth locations. AFS General Manager Wm. W. Maloney predicts a record number of working exhibits to introduce new techniques and improvements of existing processes.

Three phases of foundry operations are receiving an unusual amount of attention by manufacturers. These are materials handling, the CO_2 process, and vacuum melting.

One of the basic problems of the castings industry is how to economically move 200 tons of materials needed to produce a ton of castings. Among the exhibits will be pneumatic conveyors, vibrating conveyors, fork lift trucks, and overhead handling systems.

To demonstrate the latest developments in the CO_2 process several exhibitors will have operating exhibits demonstrating equipment for use with both cores and molds. A new phase of CO_2 operations will be the reclamation of sand. Working exhibits will show foundrymen how they can economically recover and re-use the sand.

Vacuum melting, which has been confined to laboratories until recently, will demonstrate the production of high-quality alloys on a commercial basis. The production of superalloys and improved quality of all metals has been cited by experts in the field as one of the primary steps needed to meet the more stringent demands of customers.

Castings Congress

A wide range of subjects are covered in technical papers received at the National Office. Each of the divisions will participate in the program which tentatively includes 34 technical sessions, six round table luncheons, and five shop course sessions.

A partial listing of papers submitted to the paper and program committees of the various Technical Divisions includes:

"Steel Melting Scrap for White Iron Cupola Operation."

"Some Structural Considerations in Nodular Iron."

"Improving Electric Furnace Refractory Life by Special Cooling Techniques."

"Purchase Specification for Steel Mold and Core Binders."

"Slag Composition and its Effect upon Ductility of Cast Steel."

"Hot Deformation of Molding Sand."

"Gases in Cast Iron."

"Mold Surface Behavior."

"Some Factors Influencing Abrasion Resistance of Alloy Cast Steels."

"Influence of Heat on the Bonding Properties of Bentonites."

"Observation of Pinhole Defects in White Iron Castings."

"Literature Review of Metal Penetration."

"In Defense of Low-Measured Mold & Core Gas Pressures."

"Deoxidation Practice for Copper Shell Mold Castings."

"Correlation of Green Strength, Dry Strength and Mold Hardness of Molding Sands."

"Industrial Application of Olivine Aggregates."

"New Aluminum-Magnesium-Zinc Alloy."

"Aging of Molding Sand and the Relationship of pH."

Growing T&RI Program Attracts Over 400 Students from U.S. and Canada

Plans for the new proposed Foundry Training Center building continue to develop with the appointment of architect Kenneth E. Holmes. He is currently engaged in preparing preliminary sketches, general specifications, and costs for the new structure to house T&RI activities. Convinced that learning should never stop, over 400 men of the castings industry have thus far registered for the T&RI courses.

The sixth educational course was conducted at Marquette Management Center, Milwaukee, Oct. 7-11. Entitled "Foundry Cost Reduction Through Better Methods," the course was attended by 26 men of the castings industry from 12 states and Canada. The men attending this course traveled an average of 834 miles to take advantage of the exceptional sessions conducted by Dr. Marvin E. Mundell and Norman Kobert of Marquette University; R. A. Gongwer and R. E. Trunnell, Jr. of John Deere Co.; and J. Westover, Westover Foundry Engineers.

R. E. Betterley, T&RI training supervisor, remarked that "enthusiasm, attendance, and discussions in the class left little to be desired despite the rugged competition presented by the Braves winning the World Series during the week of the courses!"

The seventh course, Advanced Sand Technology, was attended Nov. 4-8 by 81 students from 17 states and Canada. Held in Rackham Memorial, Detroit, this advanced course was for men possessing considerable experience in sand technology. A course of this caliber required the services of the following top men of the industry for instruction: H. W. Dietert and V. M. Rowell, H. W. Dietert Co., Detroit; C. E. Locke, Crucible Steel Casting Co., Cleveland; T. E. Barlow, Eastern Clay Products Dept., International Minerals & Chemical Corp., Chicago; J. B. Caine, foundry consultant, Cincinnati; J. S. Schumacher, Hill & Griffith Co., Cincinnati; C. E. McQuiston, Advance Foundry Co., Dayton, Ohio; Anton Dorfmueller, Archer-Daniels-Midland Co., Cleveland, and E. C. Zuppmann, Lake Shore Div., Bendix Aviation Corp., St. Joseph, Mich.

Cupola Melting, courses 5A and 5B, are filled to capacity. Any cancellations will be filled from the waiting list.

A Cupola Melting course will be conducted by T&RI at Hamilton, Ontario, March 16-18, in cooperation with the Ontario AFS Chapter. This service is in keeping with the T&RI long-range plans where local requirements would suggest a regional course completely handled by the Institute.

Men well versed in sand technology learn more about the subject in an advanced course.

Kresge Auditorium, M.I.T., site of conference

news

PROSPERITY PREDICTED AT NEW ENGLAND REGIONAL

J. H. Schaum

A POTENTIALLY PROSPEROUS FUTURE for the New England foundry industry was predicted in the keynote paper prepared by Howard F. Taylor, Massachusetts Institute of Technology, and Harold Brown, Hunt-Spiller Mfg. Co. In a program slanted towards the needs of management for better marketing procedures and modern production techniques, twelve highly qualified speakers gave the facts to over 400 foundrymen in attendance on Oct. 18 & 19.

Conference Chairman, Albert M. Nutter, E. L. LeBaron Foundry Co., opened the 17th New England Regional Foundry Conference in the Kresge Auditorium, the meeting house of M.I.T. The traditional address of welcome was extended to the conferees by Dr. John Chipman, head of the M.I.T. Metallurgical Department. AFS Director Henry G. Stenberg introduced AFS Vice-President L. H. Durdin who spoke briefly on behalf of the central office.

The balance of the morning session was devoted to the highly important subject "Future Prospects for New England Foundries". Besides the paper by Taylor and Brown, short talks were made and questions from the floor were answered by an industry panel comprising:

S. W. Chappell, Electric Boat Div., General Dynamics Corp.; **W. P. Jacobs,** Hartford Electric Steel Corp.; **E. Portman,** Stillman White Foundry Co.; **G. W. Roraback,** H. B. Smith Co.; **R. R. Washburn,** Plainville Casting Co.

Mr. Brown emphasized in his talk that the future of the foundry industry depends on four factors—1) the market, 2) effective management, 3) efficient production, and 4) salesmanship. The fact that millions of dollars worth of castings are being purchased by New England industries from foundries outside the New England area, indicates the existence of a lucrative casting MARKET. Dun and Bradstreet repeatedly reports that over 50 per cent of business failures stem from lack of EFFECTIVE MANAGEMENT. To obtain EFFICIENT PRODUCTION foundrymen must use wherever possible the latest technical developments to improve their operations. SALESMANSHIP is needed to create a desire on the part of a potential customer to want your cast product.

The Conference Dinner was held in the M.I.T. Faculty Club. The overflow crowd was treated to the pep and humour of Curt Gowdy—voice of the Boston Red Sox and N.B.C. sportscaster.

"Epoxy Resins for Foundry Patterns" is a subject that continues to attract foundrymen and patternmakers. M. K. Young, U. S. Gypsum Co., presented a practical talk on this subject extensively illustrated with color slides that showed how-to-do-it in your shop at a minimum cost. The new capillary resin process was introduced as a way of making core boxes and driers capable of use at temperatures to 425 F.
boxes and driers capable of use at

R. A. Colton, Federated Metals Div., American Smelting and Refining Corp., emphasized three basic steps in his talk *"Design For Quality."* 1) Recognize bad design on a pattern or blueprint. 2) Know what to do about bad design. 3) Prevent future mistakes by educating the customer.

"Are You Giving Your Customer What He Really Needs?" is the question asked and answered by R. C. Meloy, Gray Iron Founder's Society. The speaker had the answers received from 700 purchasing agents and 1500 design engineers. These men want from the foundrymen, *quality castings, assistance in the design of products, and service.* Castingmen have just begun to see the need for better marketing in which the customer comes first, last, and always.

Attending the 17th Annual New England Regional Foundry Conference, left to right, A. M. Nutter, Conference Chairman; Lew H. Durdin, AFS Vice-President; and Henry G. Stenberg, Dir., AFS.

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NORTHWEST REGIONAL FEATURES CANADIAN SPEAKERS

J. T. Hornby

The use of new methods and equipment with an eye to future markets for production of Pacific Northwest foundries highlighted the 8th annual Northwest Regional Foundry Conference held Oct. 18 and 19 at the Hotel Vancouver, Vancouver, British Columbia.

Two hundred and ten foundrymen and their wives attended the Conference sponsored by British Columbia, Oregon, and Washington Chapters of the American Foundrymen's Society and the Oregon State College Students Chapter. Charles C. Smith, General Metals Industries, Vancouver, was the Conference Chairman.

Preregistration was handled by a group headed by Gerald S. Bentley, Major Aluminum Products Ltd., and aided by a welcoming committee, Jack A. Christensen, Canada Metals Co. Ltd., Chairman.

Charles I. Brett, Industrial Engineering Ltd., in charge of reception at all events, welcomed the first official gathering at the cocktail hour, October 18. Following this social gathering, Chairman Charles C. Smith greeted the delegates at the conference banquet. After words of welcome by Frank Baker, Acting Mayor of Vancouver, AFS President, Harry W. Dietert addressed the Conference. John R. Russo, Regional Vice-President, and Herbert Heaton, National Director also were present.

G. Leonard Young, Publicity Chairman for the British Columbia Chapter, arranged for dinner and technical speakers, placing emphasis upon Canadian speakers for all events.

Guest speaker at the dinner, Dr. R. H. Wright, offered the scientist's view on *Research—Its Impact on Industry.* Dr. Wright stated that the world will be looking more and more to Canada for deposits such as potash, vital to industry.

Chairman for the morning sessions, Paul P. Hookings, Major Aluminum Products, Ltd., opened the Saturday program by presenting a film, provided by the Consolidated Mining and

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Northwest Regional Conference dignitaries, Prof. F. Forward; Chairman C. C. Smith; and AFS Presdent Dietert.

Northwest Regional

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Smelting Co. of Canada Ltd., titled, **No Man is an Island.** This film detailed the lead and zinc mining and smelting operations in the southern portion of British Columbia.

Electric furnace operation and smoke control was the topic of the first of two speeches presented at the morning session. **John R. Belyea,** Vancouver Steel Co. Ltd., presented the problem of fume control arising from the melting of scrap charges in the plant's 15-ton electric direct arc furnace for the production of semi-killed steel ingots. Mr. Belyea outlined the successes and failures preceding efficient removal of smoke from the plant. The second speaker, **Aubrey S. Tuttle,** International Nickel Co. of Canada Ltd., came from Calgary, Alberta, to deliver his talk on non-ferrous alloys utilizing nickel.

The luncheon meeting was highlighted with a speech by Professor **Frank Forward,** head of the Department of Mining and Metallurgy, University of British Columbia.

Afternoon activities were presided over by **Norman Amundsen,** Terminal City Works Ltd. He introduced Dean Goard, head of the Vancouver Vocational Institute, whose proposals on the training of foundry personnel were received with interest.

Final speaker of the day was **Franklin W. Kellam,** Electro Metallurgical Co., Toronto, Ontario, who spoke on the subject, "Cupola Operation and Cast Iron Metallurgy." Mr. Kellam advised local foundrymen that although acid cupolas find continued profitable application in foundries today, the newly developed water cooled cupola will be universally accepted.

A post-conference party concluded events at the Stanley Park Pavilion Delegates left the party with an invitation from Oregon Chapter Chairman, **Harry K. McAllister,** Western Foundry Co., to meet next in Portland when that Chapter will host the 1958 Northwest Regional Conference.

Mrs. Irah Bird, wife of Chapter Chairman Esmond C. J. Bird, Bird Aluminum Foundry Ltd., was chairman of the ladies luncheon.

Heading committees under General Chairman Smith were: **Grant E. Stephens,** Secretary-Treasurer; **Lovic P. Young,** Finance; **James T. Hornby** and **Peter Arychuk,** Entertainment; **G. Leonard Young,** Technical Program and Speakers; **Gerald S. Bentley,** Registration and Housing; **James T. Hornby,** Publicity; **Charles Brett,** Reception; **F. Godwin,** Transportation; and **Jack A. Christensen,** Greeters.

news

MICHIGAN REGIONAL EMPHASIZES AUTOMATION

P. R. Foght

Development of automated processes for foundries may become synonymous with the foundry industry of Michigan. The Michigan Regional Foundry Conference, held Oct. 2 and 3 at Michigan State University, East Lansing, included sessions that placed heavy emphasis on automation.

In presenting a paper on *Shell Molding Developments at Ford Motor Co.,* Harold C. Grant, Dearborn Specialty Foundry, Dearborn, Mich., revealed the story of automated castings production lines in use at the Ford Dearborn, Cleveland, and Dearborn Specialty foundries.

Crank-shafts, cam-shafts, gear case covers, exhaust valves, and rocker arms are among the parts now being produced in shell molds.

Automated merry-go-rounds produce and assemble the molds for the majority of these castings. Molds are produced by dumping, blowing, or by a strike-off method. Copes and drags are produced, cured, and assembled automatically. On three typical operations, manual effort was reduced to one operation in six; one operation in nine; and one operation in 22.

Foundry scrap in these operations was reported as one per cent, and machined scrap was reported to be one-half per cent.

When introducing a panel of four speakers on preventive maintenance, session chairman F. H. Hutchins, Engineering Castings, Inc., Marshall, Mich., noted that as automation increases, the preventive maintenance program becomes more a part of production scheduling and production costing.

No automated machine is better than its electrical system according to R. Belling, Albion Malleable Iron Co., Albion, Mich., Speaking on *Electrical Equipment,* he stated that plans for the installation of foundry equipment must include provisions to protect electrical components from vibration, dust, oil, and heat.

E. J. Moore, Detroit Ball Bearing Co. of Michigan, Grand Rapids, Mich., charged that preventive maintenance programs have not been effective due to lack of management effort.

Maintenance problems of compressed air systems were discussed by M. L. Williamson, Chevrolet-Saginaw Grey Iron Foundry Div., General Motors Corp., Saginaw, Mich. He stated the basic points in a maintenance program for compressed air systems as being: selection of the proper lubricant and wetting agent; inspection according to a schedule; prevention of condensation; and keeping adequate records of maintenance and repair.

Maintenance of conveyor belts was described by J. K. Stewart, Chrysler Corp., Detroit, who listed the principal causes of belt deterioration as: burning by hot sand loads and friction; puncturing by tramp iron; and improper selection and application of the belt.

Another side to the problem of automation in the metalcastings industry was presented in a luncheon talk given by G. E. Stephens, Michigan Council, UAW-CIO. He discussed the problems of workers displaced by automation and prospects for retraining programs which would help these workers find new employment in their industry.

The Michigan Regional Foundry Conference drew an attendance of 359, including 105 students. The program was arranged by a general committee headed by Conference Chairman **R. B. Kropf,** International Nickel Co., Detroit. Other members of the committee were: vice-chairman, **W. E. Truckenmiller,** Albion Malleable Iron Co., Albion, Mich.; secretary, **J. R. Young,** Cadillac Motor Car Div., General Motors Corp., Detroit; treasurer, **C. C. Sigerfoos,** Michigan State University; permanent secretary-treasurer, **Jess Toth,** H. W. Dietert Co., Detroit.

Additional conference sessions covered the subjects of core production, casting quality control, and gamma radiography.

Speakers at the core session were Clarence Meyer, Central Foundry Div., General Motors Corp., Saginaw, Mich.; O. J. Myers, Reichhold Chemical Co., White Plains, N. Y.; and Robert Rowland, Dock Foundry Co., Three Rivers, Mich.

Mr. Meyer reported the results of an investigation into the use of CO_2 cores for white iron castings.

Mr. Rowland reviewed the basic principles of shooting cores and noted that the advantages of this technique include the use of fewer vents in the core box and reduced maintenance problems because the equipment used has fewer moving parts.

O. J. Meyers reviewed two recent developments in the CO_2 process. One development being the discovery that

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Learning of new engineering developments in automation at the Michigan Regional Conference are, left to right, Prof. C. C. Sigerfoos; R. B. Kropf, Chairman; Harry W. Dietert, President of AFS; and C. V. Nass.

Northeast Regional

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A Dorfmueller, Jr., Archer-Daniels-*Core Process*" discussed the advantages and disadvantages of the four major processes for making cores—conventional, shell, air-setting, and gas setting. The best core is the cheapest one that does the job efficiently. Each process has a place in the *foundry of the future*.

"Oil Bonded Molding Sands" are finding many uses in non-ferrous foundries according to R. A. Megaw, Baroid Div., National Lead Co. A 12 ft diameter destroyer propellor, poured into a 6 ton oil bonded sand mold, required only 1 per cent metal removal by machining as compared with 8 per cent when green sand was used. The speaker explained how to use the oil bonded sand and green sand in the same system.

G. C. Cook, General Electric Co., talked about the problems and importance of *"Managing a Foundry Professionally."* Good foundry management requires long range plans. The alternative is to drift, and to drift means to float downstream. Progress must be made in these key areas: profitability, market position, productivity, product leadership, personnel development, employee attitudes, and public responsibility.

"How to Use Foundry Manpower Effectively" is a subject important to all foundry management. Two speakers—H. H. Palmer, Lewis-Shepard Products, Inc. and J. F. Bartuccio, J. C. Corrigan Co.—told how to solve this problem through the mechanization of material handling. Mr. Palmer discussed a number of slides depicting the efficient handling of materials in the foundry with fork lift trucks and accessories. A carload of palletized fire-brick can be unloaded by one man and a fork lift truck in 1½ hours compared with 80 man-hours prior to using modern methods.

Mr. Bartuccio advised foundrymen to draw up a long range master plan for mechanizing the entire foundry before buying even the first piece of equipment. With careful advance planning and utilization equipment should pay for itself in 2 to 4 years.

C. T. Koehler, Hamilton Brass & Aluminum Castings Co., narrated a film prepared to show *"Practical Mechanization for the Small Foundry."* In their carefully integrated program mechanization was accomplished in sand handling, molding, core making, shakeout and cut-off.

"Applications of Metal Injections in Gray Iron" were detailed in a talk

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Northeast Regional

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by W. R. Lysobey, National Carbide Div., Air Reduction Co. Carbide injection into cupola metal converts undesirable Type D graphite over to Type A in a 100 per cent pearlitic matrix. As a result physical properties are raised, shrinkage is reduced, less risers are needed, sulfur is lower, chill is reduced, and fluidity raised.

R. W. Ruddle, Foundry Services Inc., described the *"Treatment of Non-Ferrous Metals"* with fluxes, gas removers, and grain refiners. H2 gas in alumiunm is best removed with chlorine gas or compounds containing chlorine. Grain refining of aluminum seems to be more dependable if 0.03 per cent titanium and 0.01 per cent boron are both added.

The New England Regional Foundry Conference program was arranged by Chairman A. M. Nutter and the following: **C. W. Armstrong,** vice-chairman; **K. W. McGrath,** ferrous program co-chairman; **P. T. Mongeau,** ferrous program co-chairman; **W. A. Helmedach,** non-ferrous program co-chairman; **E. F. Tibbetts,** non-ferrous program co-chairman; **F. S. Holway,** publicity chairman; **J. H. Orrok,** registration and reception chairman; and **H. H. Klein,** treasurer.

Michigan Regional

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gases other than CO_2 can be used to set the sodium silicate binder; the other being the application of alternate vacuum and pressure-gassing cycles.

D. M. Murray, Albion Malleable Iron Co., Albion, Mich., presented a paper on *Gamma Radiography.* He discussed the nature of radioisotopes and radioactivity and introduced the foundrymen to the nomenclature, hazards, protection requirements, and government regulations encountered when this inspection technique is used.

Two speakers presented the subject of quality control: Robert Cope, Rapid Cast Corp., Grand Rapids, Mich., and W. T. Shute, West Michigan Steel Foundry Co., Muskegon, Mich.

Mr. Shute reviewed and summarized the problems of dimensional change in steel castings and discussed the principal causes of variance from ideal dimensions.

An accurate understanding between the customer and the plant is a vital part of a quality control program, Mr. Cope stated. He remarked that the plant's quality control people and customers should meet; preventing rejection of castings due to variance in interpretation of specifications.

AFS Instructors Seminar Will be Held June 19-21

■ A practical survey of basic foundry operations will be presented to foundry instructors at the 3d Annual Foundry Instructors Seminar to be held June 19-21 at Case Institute of Technology, Cleveland.

Workshops, field trips, lectures and training films will be used to brief vocational and high school foundry teachers in current developments in the castings industry.

Two previous seminars were held at Michigan State University, East Lansing, Mich. The seminars are sponsored by the Education Division, American Foundrymen's Society.

A tentative program has been released by the Foundry Instructors Seminar Committee of the AFS Education Division. A field trip will be conducted to a Cleveland foundry Thursday morning with a discussion of the trip scheduled for the afternoon. Other Thursday activities will include a discussion of the scope of new casting developments, a training film, a discussion of the AFS Training and Research Institute, and workshop orientation. Workshops will be conducted during the evening following a dinner.

On Friday workshop reports will be made and discussions held on foundry practices and a social hour and dinner will be held at the Tudor Arms Hotel.

Saturday morning will be devoted to workshop activities. The three-day program will conclude Saturday afternoon with an evaluation meeting.

Birmingham District

Open Technical Sessions

■ Two technical sessions at the Oct. 11 meeting opened the 1957-58 program. Michael Bock II, Exomet, Inc., Conneaut, Ohio, discussed *"Exothermic and Insulating Materials as Aids for Better Feeding."*

Michael Bock, II.

Nodular iron and its application were explained by T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa. Mr. Eagan mentioned the difficulties encountered in finding engineers willing to accept nodular iron as a replacement for older and more familiar materials.

S. D. Moxley, American Cast Iron Pipe Co., Birmingham, Ala., discussed the founding and operations of his company and its production of centrifugally cast steel and iron pipe.—*D. E. McGill.*

Central Illinois

Epoxy Resin Applications

■ A panel discussion on patterns opened this year's technical program. Ray Olson, Southern Precision Pattern Works, Birmingham, Ala., spoke on *"Engineering a Pattern."* Robert LeMaster, Nelson Pattern Co., Milwaukee, discussed *"Use of Plastics for Patterns."* Robert Selberg, Caterpillar Tractor Co., Peoria, Ill., served as moderator.—*H. L. Marlatt.*

Moderator Selberg flanked by speakers Olson and LeMaster.

Central New York

Core Blowing Discussion

■ Chapter members at the October meeting held at the Mark Twain Hotel, Elmira, N. Y., heard a discussion of *"Coremaking—Shooting or Blowing,"* presented by Z. Madacey, Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago. Mr. Madacey showed how jobbing and semi-production foundries could adopt their operations to core blowing. He stated that the two most important factors to consider would be sand control and rigging of the core boxes.

Sand core boxes can be used on a blowing machine, however, if new boxes are being purchased, they should be adapted to the blowing machine rather than to sand cores.

Mr. Madacey stated that cores weighing up to 400 lb have been blown using air pressures up to 140 psi. Advantages listed for core blowing included accuracy, speed, and improved quality.—*C. W. Diehl.*

Three former **Central New York Chapter** Chairmen attended the October meeting. Left to right are Curtiss M. Fletcher, Fairbanks Valve Co., Binghampton, N. Y.; AFS National Director William C. Dunn, Oberdorfer Foundries, Inc., Syracuse, N. Y.; and Robert A. Minnear, Ingersoll-Rand Co., Painted Post, N. Y.

Central Ohio Chapter

Effects on Pouring Rates

■ An illustrated lecture on *"Gating to Control Pouring and Its Effect on Castings,"* was presented by C. E. Drury, Central Foundry Div., GMC, Danville, Ill. at the October meeting.

The topics discussed were

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AFS news

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how the pouring rate was affected by sprue cups, post diameter, length,

Speaker C. E. Drury

runner area, chokes, ladle height, and skim cores.—*Jose Acebo.*

Detroit Chapter

Efficient Cupola Operations

■ Fundamentals of cupola operation were outlined by William Dawson, Kelsey-Hayes Wheel Co., Detroit, at the October meeting. Approximately 160 foundrymen attended.

Emphasis was placed on the qualtiy of materials used in the charge makeup relative to the consistency of chemical analysis and size and shape of the materials. Mr. Dawson further elaborated on the charge makeup relating to the size, hardness, and consistency of the coke.

Problems of maintaining a constant watch on the critical areas of the cupola were emphasized. The areas include bosh size maintained at a constant diameter, bed sand height being duplicated daily, and proper maintenance of tuyeres.

Maintaining the relation of blast air to coke ratio in the charge was listed as one of the most neglected phases of cupola operation. It is easily controlled if proper emphasis is applied, Mr. Dawson stated.

After the important data has been maintained it is essential that this information be relayed to the workers involved. Constant checks must be made and applied to ensure the success of good cupola operation. —*Arthur M. Clark.*

Tri-State Chapter

Risering and Feeding

■ Principles of risering and gating were discussed at the October meeting held at Joplin, Mo. Missouri Steel Castings Co. acted as host.

H. F. Bishop, Exomet, Inc., Conneaut, Ohio, presented an illustrated lecture covering the basic principles of risering and feeding castings.

Edward A. O'Brien, chapter chairman, presided. Chapter vice-chairman E. F. Hines served as technical chairman.—*Leslie A. O'Brien.*

Philadelphia Chapter

William B. Coleman Night

■ Approximately 120 foundrymen attended the opening of the Philadelphia Chapter's technical program. The first program is known as William B. Coleman Night in honor of the former chapter chairman. H. E. Taylor, Massachusetts Institute of Technology, Cambridge, Mass., discussed "*Food for Thought*," covering many scientific experiments in sand and how they can benefit foundries. Several past chapter chairmen attended. Former chairman W. S. Giele was awarded a portable television set from the members.—*E. C. Klank.*

Eastern New York

Core Practices Outlined

■ Four core practices were outlined by O. Jay Myers, Reichhold Chemi-

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AFS Director O. Jay Myers Shown with chapter chairman H. C. Winte, speaker Taylor, program chairman D. E. Best.

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cals, Inc., White Plains, N. Y. at the October meeting. Mr. Myers discussed conventional, shell, self-curing, and CO_2 techniques. Each was evaluated as to type, sand used, moisture, green strength additives, bake strength additives, hot strength additives, mixing cycle, costs, and applications.

The speaker also described the use of resins in shell casting and the problems encountered in making up coated sands. Liquid, powdered, and crushed resins were detailed.—*Leonard C. Johnson.*

Metropolitan Chapter

Growing Use of Epoxy Resins

■ Epoxy resins and their growing importance in the foundry industry were discussed at the October meeting by M. K .Young, U. S. Gypsum Co., Chicago.

Introduction of epoxy resins has overcome many of the difficulties experienced earlier with phenolic resins and polyesters, Mr. Young pointed out. He listed the advantages of expoxies as: heat and wear resistance; dimensional stability; ability to cure at room temperatures; good sand release; and low production cost.

Slides were used to demonstrate the steps in producing patterns. A demonstration was made of a new plastic material which resists heat distortion up to 440 F.—*C. H. Fetzer.*

Saginaw Valley

Planning for the Future

■ Approximately 200 members and guests attended the October meeting featuring a talk on *"Planning for the Twentieth Century,"* by Dr. R. F. Thomson, Metallurgical Engineering Dept., General Motors Corp.

The speaker stated that the foundry industry must not only exert every effort to meet today's requirements but also must be aware of various trends in customer requirements. He cited the increasing use of light metals in the automotive industry as an example.

The importance of finding money to support foundry research and to attract top level young men to work on research projects was also emphasized.—*R. J. Gleffe.*

Twin City Chapter

Discuss Human Engineering

■ More than 100 foundrymen attended the October meeting held at the

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dietrich's corner

by h. f. dietrich

We are constantly reminded that we have, and will have for sometime, a shortage of engineers. Is this a fact, or is industry wasting manpower by assigning to engineers jobs that could be handled by intelligent people trained over a shorter period of time?

Soon, the colleges and universities all over the country will be graduating another crop of engineers. Armed with a slide rule, a set of drawing instruments, and a head full of formulae and odd facts, these wide-eyed young men will eagerly attack the world.

The conservative world will resist change as usual, and after a period of conditioning frustration, these ambitious, radical, confidently naive youngsters of today will become the steady, conservative management of tomorrow.

Our industrial world is subject to constant change. Even the meaning of the word "engineer" has undergone a change in the past thirty years, at least in the mind of the layman. It once was a term of derision used as we use "Communist" today. If you thought someone was overstepping his authority he was called an engineer with appropriate adjectives. I had been in foundries for about three years before I learned that "godamengineer" was more than one word.

The pseudo-engineers of that day brought this on themselves by their overbearing attitude. Of course, top management helped it along by assigning to engineers projects that either exploited employees, or in some way curtailed their activity.

A friend of mine who had been graduated from Marquette University went to work for a progressive concern. This company had become production conscious. They thought the reason production lagged was because the employees were spending too much time leading leisurely lives. Pipes, Bull Durham, and "making" cigarettes were banned in the shop to save down-time. When the graduate engineer reported for work, his first assignment was to design a rest room that would not lend itself to the study of the Police Gazette and the Sears and Roebuck catalog.

With his knowledge of strength of materials, stress factors, physics, and higher mathematics, he approached the problem with an engineering viewpoint and came up with a solution. He designed a terra cotta soil pipe flush system. By placing a series of tee joints at proper distances, he could bring up risers of 14 inch soil pipe for seats; and by raising the top of the pipe 25 inches above the floor, it was uncomfortable to any except a very tall man.

The removal of all other furniture from the room made a visit to this rest room an ordeal of necessity only. It was never used as a study room for further education. It was quite natural that the employees should blame the godamengineer for their discomfort.

Another engineer friend of mine, with an M.E. degree and exceptional drafting ability, spent nine years on a drawing board before he quit to utilize his skill for another company.

It is reasonable to assume that an engineer in a plant should spend some time on various phases of manufacture in that plant. But, I wonder how many engineers are held in routine jobs because they possess exceptional aptitude for that job?

How much of this much needed skill is being wasted by being held on stock chasing, routine drafting, minor supervision, inspection, and clerical work? If you hire an engineer, you should use the specific engineering skill for which he has been educated.

Not all graduate engineers are physically or psychologically suited to life in the dreamer's ivory tower. Some of the present graduates will go into active production control. Some will prefer to remain in supervision. A few will become educated beach combers.

In a free economy, we can't dictate a man's life. But we can relieve the shortage of engineers by making the most efficient use of the talent and skill of those who are willing and able to go into the engineering field.

Don't sell these boys short! In their hands rests the future of our mechanical and electronic world.

FOUNDRY FACTS NOTEBOOK

Introduction to Brass and Bronze Melting

FOUNDRY FACTS NOTEBOOK *is designed to bring you practical down-to-earth information about a variety of basic foundry operations. As the name implies, this page is prepared for easy removal and insertion into a notebook for handy future reference.—Editor.*

The process of converting solid metal to the liquid state suitable for casting in the foundry is generally one of transferring the heat produced by the burning of fuel, either gas or oil, or through the use of electrical energy, to the metal to raise its temperature until it is molten.

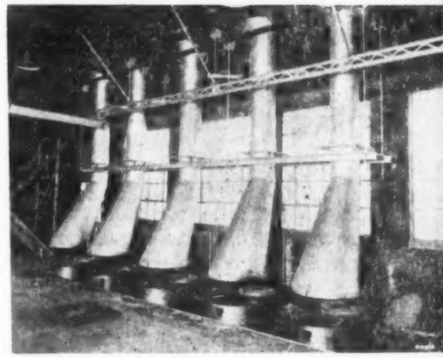
For each metal and alloy a specific amount of heat is required to raise the temperature to the melting point, and at that point further heat is required to change the metal from solid to liquid. If additional heat is applied to the now liquid metal, a number of things can occur. The most important are the following:

- The temperature of the liquid bath will be raised. This is quite understandable since more heat applied to the liquid will continue to raise its temperature until some other action occurs.
- The metal may become more fluid. As additional heat is applied to the molten metal bath the molecular activity of the metal increases so that greater fluidity is observed. This is a common observation in many materials, i.e., as the temperature is raised, the material becomes more liquid.
- Volatile constituents may be driven off, i.e., if the additional heat applied raises a constituent such as zinc above its boiling point, it may be driven off as a fume.
- Part of the alloy or metal may become oxidized. The rate of oxidation of the various elements present in an alloy depends somewhat on the temperature and the composition. As the temperature is raised, the various elements present will tend to oxidize out preferentially, provided a supply of oxygen is available. In other words, in a standard 85-5-5-5 bronze it is possible to oxidize out the tin, lead and zinc if adequate oxygen is available and the temperature is sufficiently high.
- The tendency to dissolve gases becomes greater. Unlike water and many other fluids, metals tend to dissolve greater quantities of gases as the temperature is increased. Solid metals will dissolve very little gas, whereas liquid metals will dissolve great quantities depending upon the composition. In general, the higher the temperature, the more gas the metal will dissolve.

The function of the melting furnace is to supply molten metal, when and as needed, of satisfactory quality and at a suitable temperature, at the lowest possible cost. These, together with desirable working conditions, are the factors which govern the choice of melting equipment and the manner in which it is to be operated.

Non-ferrous foundries vary greatly in size and in the nature of their operations, with consequent employment of a wide variety of furnace types and melting practices.

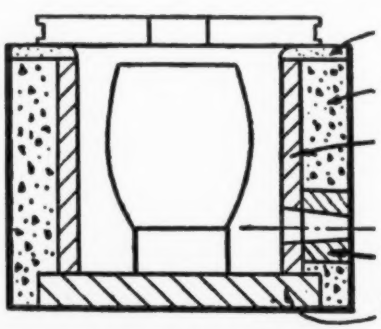
In non-ferrous melting little or no consideration would be given to refining the metal while it is being melted. The prime object is to charge good metal into the furnace and deliver it in molten form without impairment. In recent years the use of composition ingot, already alloyed in the desired proportions, has become almost universal.



Hoods for venting carry off fumes of non-ferrous melting process.

Alloy ingot to meet almost any desired specification is readily obtainable, and the melter need not concern himself with alloying procedures. He should, however, make certain by chemical analysis and physical test that the ingot is of satisfactory quality.

The size and type of furnace to be used depends primarily upon the volume of production, the size of the castings to be made and the character of the alloys in use. The availability and cost of different fuels is a factor, as is the convenience of changing from one alloy to another in a foundry where this



Crucible furnace melts metals and alloys in a refractory crucible.

is a frequent necessity. Each type has its limitations.

Regardless of type, the size of furnace employed should have a direct relationship to the size of castings to be made, or more specifically, to the number of molds to be poured from one furnace heat. If the metal is melted in a crucible which is lifted from the furnace and used to pour directly into molds, the capacity of the crucible should be no greater than the amount of metal which can be poured before it becomes too cold to pour. If molds are poured from a ladle which receives its metal from a hearth-type furnace, the capacity of the furnace should equal the capacity of the ladle multiplied by the number of pouring crews employed. In this way the furnace can be emptied quickly and put back in service without delay.

Furnaces which may be used for melting brass and bronze alloys include:

1) Indirect-arc,
2) Vertical-ring induction,
3) High-frequency induction,
4) Indirect-resistance,
5) Crucible-pit,
6) Crucible tilting,
7) Open-flame,
8) Reverberatory,
9) Cupola.

Metal Quality

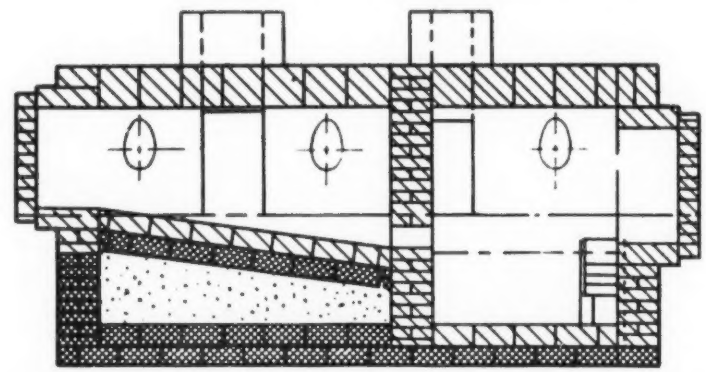
Metal of good quality can be obtained from any of the furnaces mentioned, if the proper operating procedure for each is understood and carefully followed. The impairment of metal quality during melting may come from four sources: 1) the refractory lining or crucible; 2) direct contact with the fuel; 3) foreign materials introduced with the charge or during the melt; 4) furnace atmosphere.

As a rule, extreme caution is not necessary for furnaces which do not subject the lining to intense and localized heating. Silicon carbide is safely used in crucibles and in many furnace linings, although its affinity for lead must always be remembered. Even in the arc, high-zinc—low-lead alloys do not seem to suffer from contact with refractories containing this material.

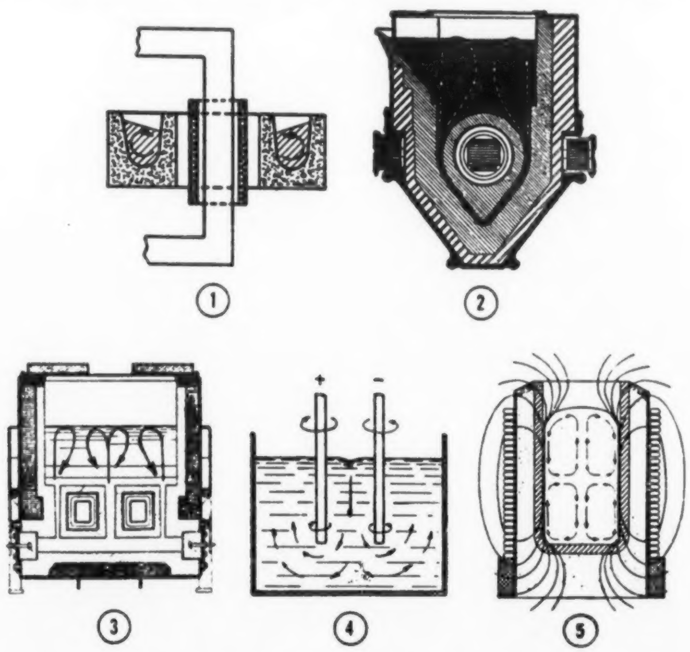
In shifting from one alloy to another it sometimes happens that an important constituent of the first alloy is an undesirable impurity in the second. This offers no problem if crucibles are used, but requires attention in any hearth-type furnace, electric or fuel-fired, because some metal is sure to be trapped in joints of the brickwork. A single small "wash" heat usually takes care of this situation.

Good practice requires that the metal to be melted should be free from foreign materials. This applies particularly to water, oil, or any sort of organic material. Sand adhering to foundry returns is not likely to cause trouble. Some foundries clean foundry returns by blasting before melting; this is unquestionably sound practice if the inconvenience and expense can be justified.

■ This information was abstracted from COPPER BASE ALLOYS FOUNDRY PRACTICES, published by the American Foundrymen's Society.



Barrel furnace has two chambers; one for breakdown, one for holding.



Various types of induction furnaces; (1) old Kjellin or ring type; (2) Wyatt submerged resistor; (3) Tama-Wyatt submerged resistor; (4) Hultgren immersed electrode salt bath; (5) Northrup high frequency.

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Jax restaurant, Minneapolis. Wm. M. Ball, Jr., R. Lavin & Sons, Chicago, discussed human engineering.

Mr. Ball explained how human problems affected worker efficiency.

Wm. M. Ball, Jr.

One effect was that of fear which has a degrading influence on a worker's constructive abilities. In the case of a grinding wheel operator, the feeling of fear may cause him to operate his machine improperly resulting in decreased production or even lead to an accident.—*J. David Johnson.*

Quad City Chapter

Explain New Casting Process

■ Rex Jennings, John Deere Tractor Co., Waterloo, Iowa, presented a film on the X-process, developed by the

Technical Chairman Tolmie gives award to Rex Jennings

John Deere Waterloo Works, at the October meeting. The first public showing of the film explained the process developed to produce close-dimensioned castings with excellent finishes using a resin-bonded sand. The process consists of blowing a resin coated sand liner ¼-⅜-in. thick between a hot contoured flask and a hot pattern.

The process, which has produced castings up to 250 lb, has reduced cleaning and installation times compared to green sand practices.

Mr. Jennings was the featured speaker. He traced foundry develop-

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ments during the past 25 years and outlined the transition from hand labor to modern conveyors, air hoists, and other labor-saving improvements. Mr. Jennings stated that further increases can be expected in shell molding and the CO_2 processes to meet increasingly stricter tolerances.

Approximately 70 members attended the meeting held at the Fort Armstrong Hotel, Rock Island, Ill.—*Grant F. Thomas.*

Pittsburgh Chapter

Evaluate Core Processes

■ An evaluation of various core processes was presented by C. E. Coulter, Archer-Daniels-Midland Co., Cleveland, at the October meeting. More than 130 members attended the meeting which included an open discussion. Chapter President George J. Miklos presided.—*Walter Napp.*

Wisconsin Chapter

Testing for Casting Design

■ *"The Advantages of Proper Casting Design,"* were outlined at the October meeting by R. L. Gilmore, Superior Steel & Malleable Castings Co., Benton Harbor, Mich. A movie was

R. L. Gilmore

shown illustrating the use of nondestructive testing in castings design.

The speaker described the use of strain gages and brittle lacquer for determining areas of high and low stress.—*Bob De Broux.*

Early Apprentice Entries Indicate Record Turnout

■ Entries received during the first two months of the Robert E. Kennedy Memorial Apprentice Contest, sponsored by the American Foundrymen's Society, indicate a record number of participants. The contest during 1957 attracted nearly 600 apprentices; some 900 are anticipated for the 1958 competition.

Participants are reminded that successful entries from local Chapter contests, or individual plant contests, should be shipped only to Prof. R. W. Schroeder, University of Illinois, Navy Pier, Chicago. Entries are not to be mailed to the AFS Central Office, Des Plaines, Ill.

Entries to be considered for national judging must be received no later than 5 pm, April 7, 1958. It is urged that all local contests be completed no later than Wednesday, March 19, 1958 in order to allow sufficient time for shipping.

All official registration tags provided for the entries must be properly executed. Incomplete tags will be grounds for disqualification.

Regulation Change

A 1958 regulation change states that all castings shall be sand blasted but not coated. In previous years castings were allowed to be coated.

Plants submitting entries are cautioned that entries can not be entered directly into national competition if local chapter contest is being conducted in their plant area. In plant competition, only first place winners may be entered in the national contest. However, the 1st, 2d, and 3rd place winners in each division of chapter competition may be submitted for national judging.

afs chapter meetings

DECEMBER

Birmingham District . . *No Meeting.*

British Columbia . . *No Meeting.*

Canton District . . Dec. 7 . . American Legion Club, Massillon, Ohio . . *2d Annual Ladies' Night Dinner Dance.*

Central Illinois . . Dec. 14 . . American Legion Hall, Peoria, Ill. . . *Annual Christmas Party.*

Central Indiana . . Dec. 2 . . Athenaeum Turners, Indianapolis . . Panel: K. Williams, Link-Belt Co., R. G. Kimble, Fabricast Div., GMC, C. A. Newmier, Frank Foundries Corp. and C. Neese, Electric Steel Castings Co. Moderator: B. E. Gavin, National Malleable & Steel Castings Co. *"Finishing Operations on Castings."*

Central Michigan . . Dec. 18 . . Hart Hotel, Battle Creek, Mich.

Central New York . . Dec. 14 . . Onondaga Hotel, Syracuse, N. Y. . . *Christmas Party.*

Central Ohio . . Dec. 9 . . Seneca Hotel, Columbus, Ohio . . D. E. Krause, Gray Iron Institute, *"Foundry Research Development—A Progress Report."*

Chesapeake . . *No Meeting.*

Chicago . . Dec. 2 . . Chicago Bar Association, Chicago . . *Gray Iron & Steel Group:* A. S. Grot, Edward Valves, Inc., Rockwell Mfg. Co., *"Gating and Risering for X-ray and Pressure Quality"; Malleable Group:* L. Winings, Wagner Malleable Iron Co., *"Gating and Feeding Malleable Castings"; Maintenance Group:* J. E. Bolt, General Electric Co., *"Shell Molding Equipment";* Pattern & Non-Ferrous Group: E. Moyer, Howard Foundry Co., *"Pattern Quality & Maintenance."*

Cincinnati District . . Dec. 21 . . Netherland Hilton Hotel, Cincinnati . . *Annual Christmas Party.*

Connecticut . . Holiday Party Jan. 7.

Corn Belt . . Dec. 14 . . Italian Gardens, Lincoln, Neb. . . *Annual Christmas Party.*

Detroit . . *No Meeting. (Ladies' Night Dinner Nov. 30, Glen Oaks Country Club, Detroit.)*

Eastern Canada . . Dec. 13 . . Sheraton-Mt. Royal Hotel, Montreal, Que. . . J. G. Dick, Canadian Bronze Co. Ltd., *"Old and New Ideas in Bronze Casting."*

Eastern New York . . Dec. 17 . . Panetta's Restaurant, Menands, N. Y.

Metropolitan . . Dec. 13 . . Essex House, Newark, N. J. . . *Annual Christmas Party.*

Mexico . . *No information available.*

Michiana . . Dec. 9 . . Club Normandy, Mishawaka, Ind. J. Reedy, Delh: Foundry Sand Co., *"CO_2 Process."*

Mid-South . . Dec. 7 . . Claridge Hotel, Memphis, Tenn. . . *Annual Christmas Party.*

Mo-Kan . . Dec. 7 . . Hotel President, Kansas City, Mo. . . *Annual Christmas Party.*

New England . . Dec. 10 . . University Club, Boston . . *Ladies' Night.*

Northeastern Ohio . . Dec. 6 . . Tudor Arms Hotel, Cleveland . . *Christmas Stag Party.*

Northern California . . Dec. 16 . . Spenger's Berkeley, Calif. . . M. E. Ginty, Vulcan Steel Foundry Co., R. D. Genger, Pacific Steel Casting Co., and G. W. Stewart, East Bay Brass Foundry. *Casting Clinic.*

Northern Illinois & Southern Wisconsin . . Dec. 7 . . Hotel Faust, Rockford, Ill. . . *Annual Christmas Party.*

Northwestern Pennsylvania . . *No information available.*

Ontario . . Dec. 20 . . Royal Connaught Hotel, Hamilton, Ont. . . J. P. Lubenkov, Link-Belt, Ltd., G. M. Johnston, Neptune Meters, Ltd., and T. Tafed III, American Standard Products (Can.) Ltd., *"Cost Control."*

Oregon . . Dec. 14 . . Multnomah Hotel, Portland, Ore. . . *Annual Christmas Dance.*

Philadelphia . . Dec. 10 . . Sheraton Hotel, Philadelphia . . *Annual Christmas Party.*

Piedmont . . *No Meeting.*

Pittsburgh . . Dec. 9 . . Penn-Sheraton Hotel, Pittsburgh, Pa. . . *Annual Christmas Party.*

Quad City . . Dec. 13 . . Blackhawk Hotel, Davenport, Iowa . . *Annual Christmas Party.*

Rochester . . Dec. 3 . . Gleason Works, Rochester, N. Y. . . *Foundry Tour.*

Saginaw Valley . . Dec. 5 . . Fischer's Hotel, Frankenmuth, Mich. . . W. R. Weaver, Modern Pattern & Plastics, Inc. and A. Kerr, Bakelite Co., Div. Union Carbide Corp., *"Use of Plastics in the Foundry."*

St. Louis District . . Dec. 12 . . Edmond's Restaurant, St. Louis . . E. H. King, Hill & Griffith Co., *"Molding Sands & Molding Methods."*

Southern California . . Dec. 13 . . Rodger Young Auditoriam, Los Angeles . . *Castings Clinic; panel of local foundrymen.*

Tennessee . . *No Meeting.*

Texas . . Dec. 6 . . Student Memorial Center, College Station, Texas.

Timberline . . Dec. 9 . . Oxford Hotel, Denver, Colo. . . *Annual Christmas Party.*

Toledo . . Dec. 4 . . Heather Downs Country Club, Toledo, Ohio . . F. G. Steinebach, Penton Publishing Co., *"Future of the Foundry Industry."*

Tri-State . . Dec. 14 . . Mayo Hotel, Tulsa, Okla. . . *Annual Christmas Party.*

Twin City . . Dec. 14 . . Leamington Hotel, Minneapolis . . *Annual Christmas Party.*

Utah . . *No Meeting.*

Washington . . Dec. 19 . . Engineers' Club, Seattle.

Western Michigan . . Dec. 7 . . Bill Stern's, Muskegon, Mich. . . E. H. King, Hill & Griffith Co.

Western New York . . Dec. 5 . . Sheraton Hotel, Buffalo, N. Y. . . H. J. Weber, AFS, *"Legislation Affecting Foundries."*

Wisconsin . . Dec. 13 . . Schroeder Hotel, Milwaukee . . *Christmas Party.*

Understanding Your Customer's Problems is Key to Progress, F.E.M.A. Hears

■ Understanding your customer's problems is the key to increased sales, manufacturers were advised at the 39th annual meeting of the Foundry Equipment Manufacturers' Association held Oct. 17-19 at the Greenbrier, White Sulphur Springs, W. Va.

More than 150 persons representing equipment manufacturers attended the meeting which featured a talk on "*What the Foundry Industry*

Speaker F. W. Shipley

Expects from the Equipment Manufacturers." The address was given by AFS Past President F. W. Shipley, Caterpillar Tractor Co., Peoria, Ill.

Panel Discussion

Marketing of foundry equipment was discussed by a 4-man panel, R. A. Brackett, Spencer Turbine Co., Hartford, Conn., serving as moderator.

C. H. Barnett, Foundry Equipment Co., Cleveland, discussed briefly direct selling. He pointed out that the effect of advertising cannot be limited to a definite period of time since its influence is felt long after the merchandise has been delivered.

J. R. Bloom, Davenport Machine & Foundry Co., Davenport, Iowa, outlined the importance of maintaining field service. Its prime purpose, he stated, is to insure high level performance of equipment after it has been installed. He recommended the design of products for maximum life and ease of lubrication.

C. G. Hawley, Jeffrey Mfg. Co., Columbus, Ohio, discussed the writing of contracts. All contracts, he noted must be in writing to avoid differences of opinion and controversies and must be fair to both parties.

H. E. Helling, Jr., Mathews Conveyor Co., Ellwood City, Pa., spoke on sales promotion. Advertising's basic purposes were defined as making the initial contact, arousing interest, and creating preference. He recommended that before advertising and promotion programs be undertaken that they answer three questions: Why spend the money? What should you expect the campaign to accomplish? Will the results be obtained?

During the discussion period Mr. Helling advocated the use of special trade publications over business magazines for basic advertising programs.

Trade shows were also advanced as an excellent means for sales and sales promotion programs.

Manufacturers Opportunities

In analyzing the equipment manufacturers responsibilities, Mr. Shipley recommended continuous improvements in equipment and technology which will attract personnel with a higher level of education.

"To accomplish such continuous improvement, most foundrymen feel the foundry equipment industry should devote more effort in improved application. If you are able to develop improved equipment or processes which would make it more profitable for the foundrymen to use, I have no doubt that he will find a way to buy it," Mr. Shipley commented.

F.E.M.A. President Seavoy

The following recommendations were made by the speaker:

Material handling—A fertile field for concentrated research since a foundry handles 200 tons of material for every ton of finished casting.

Metal melting and metallurgical control—Research to date has allowed considerable improvement, however, new metals must be developed to meet the demands of high speeds, outputs, and temperatures of the jet and atomic age.

Safety, hygiene and air pollution—Considerable research needs to be done to improve the foundry environment in order to attract a better grade of personnel.

Noise—Excessive noise creates just as undesirable a working atmosphere as smoke and dust from the medical standpoint.

Hydraulics—The field has a great potential in the design of foundry equipment, where accurate, positive, noiseless control of power is desired.

Maintenance—Machine design improvements are needed to reduce machine down-time and maintenance costs. This can be done by designing machines and components for rugged service and convenient maintenance.

Frank G. Steinbach, secretary, National Castings Council, and Edward J. Walsh, Foundry Educational Foundation, presented reports on their societies. Wm. W. Maloney, general manager, American Foundrymen's Society, told of plans for the AFS Castings Congress and Show to be held in Cleveland, May 19-23.

F.E.M.A. officers elected were: president, Gordon E. Seavoy, Whiting Corp., Harvey, Ill.; vice-president, Einar A. Borch, National Metal Abrasive Co., Cleveland; executive secretary-treasurer, C. R. Heller, Washington, D. C.

Circle No. 166, Page 7-8

the SHAPE of things

safety, hygiene, air pollution

by HERBERT J. WEBER

POTPOURRI

Sulphur in Cupola Stack Gases: The British Cast Iron Research Association found that the amount of oxides of sulphur emitted by cupolas is much less than that emitted from typical solid fuel boilers burning fuel at comparable rates.

It is reported that 40-70% of the coke sulphur is absorbed by the metal and slag, by far the greater proportion going into the metal.

Accidents: Can you top this world record? The Old Hickory Plant of E. I. duPont de Nemours & Co. worked 28,743,768 injury-free man-hours.

Automobile Paint Damage by Airborne Iron Particles: Results of the examination of cars parked in a parking lot adjacent to a plant, exposure of painted test panels, and laboratory exposure of test panels indicated that car finish was damaged by iron particles. In this particular lot, iron dust from a grinding-wheel exhaust system was traced to the plant. The cost of refinishing a lot of cars can come high.

Pre-employment Audiograms: The Wisconsin Manufacturer's Association has been advocating the use of audiometer tests in pre-employment physical examinations, but so far the campaign has not been successful.

One wonders why management insists on eventually paying for a pre-existing loss of hearing. It has been frequently found that a large percentage of men seeking employment already have impaired hearing.

Here's What the Judge Said: A core assembler and sprayer was awarded compensation for total disability due to silicosis. Although it was admitted that the man had silicosis prior to his employment in the defendant foundry, the New York Supreme Court ruled that under the statute, the employer in whose employment the last injurious exposure occurred, is liable.

If rulings of this type continue, management will refuse to hire anybody who can't pass a physical examination comparable to that given by the U. S. Marines.

Read U. S. Department of Labor Bulletin no. 190 "Second Injury Funds" and see if such a court decision is consistent with the intent of the Workmen's Compensation Act of New York State.

Death by Fire: He was a foreman in the shell molding department. He decided to speed up production by mixing his resin and alcohol near the shell curing ovens. In order to hurry up the mixing job, he stuck the compressed air hose into the mixing drum and turned on the air. The alcohol was vaporized; he was thoroughly splashed with it; and the vapors igniting from the oven burners set fire to him. He was burned to death before anyone had a chance to save him.

It was mighty tough on the boss when he had to tell the family. It even bothered him to discuss the details, but he did in the hope that the publishing of the story would prevent another foundryman from meeting the same fate.

Think This One Over: New Jersey has a state-wide air pollution law. A proposal has been made that the rate of emission from a stack be determined by the hourly Btu value of the fuel. If this proposal is applied to cupolas, would it give foundries a fair shake? Hint: Cupolas use iron to coke ratios as high as 10 to 1. Now let's have your answer.

Speaking of answers, Byron A. Berg, Allis-Chalmers Manufacturing Co., West Allis, Wis., came up with the only correct answer to October's *Facts & Fallacies* contest.

For the benefit of those of you who tried but didn't quite measure up to the knowledge of plant hygiene displayed by Mr. Berg, here are the correct answers:

True statements; No. 1, 7, 8, 9, 10, 13, 15.

False statements; No. 2, 3, 4, 6, 11, 12, 14.

You should have checked *B* as the right answer for question no. 5.

In return for the few minutes time to circle the above right answers, Mr. Berg is being sent a copy of ENGINEERING MANUAL FOR CONTROL OF IN-PLANT ENVIRONMENT IN FOUNDRIES.

Classified Advertising

For Sale, Help Wanted, Personals, Engineering Service, etc., set solid . . 25c per word, 30 words ($7.50) minimum, prepaid.

Positions Wanted . . 10c per word, 30 words ($3.00) minimum, prepaid. Box number, care of **Modern Castings,** counts as 10 additional words.

Display Classified . . Based on per-column width, per inch . . 1-time, $18.00; 6-time, $16.50 per insertion; 12-time, $15.00 per insertion; prepaid.

Help Wanted

Foundry Superintendent

Wanted—Man to take complete charge of sand foundry operations of large foundry in Milwaukee area. Must have previous experience in supervising either steel or non-ferrous casting production including melting, molding, and coremaking. Prefer man in 40 to 50 year bracket who is thoroughly familiar with the production of large castings up to 20,000 lbs. Salary open. Please reply stating your personal data, qualifications, experience, salary expected and availability in first letter. Direct all correspondence to **AMPCO METAL, Inc. Personnel Department, 1745 South 38th St., Milwaukee 46, Wisconsin.** All inquiries will be held in strict confidence.

Wanted Foundryman with wide experience and knowledge of gray iron metallurgy and prepared to travel from headquarters in Chicago area. **Box No. D-78, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

Wanted to Buy

TRANSACTIONS AFS back volumes and sets—wanted to buy for cash, also other scientific and technical **Journals. A.S.F. ASHLEY,** 27 E. 21st Street, New York 10, N.Y.

Do you have a used Sandblasting Machine? If so, please give us the manufacturer's name, size and how many blasting wheels, also the price, f.o.b. your city. **NORTHWESTERN BARREL CO., 3111 Fifth Ave., South Milwaukee, Wis.**

Wanted—Osborn Roto-Lift Molding Machine Model 3161. **Box D-90, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

WANTED! BOUND VOLUMES OF TRANSACTIONS OF AFS Arrangements to sell bound volumes of **TRANSACTIONS** of **AFS,** intact and in good condition, may be made through AFS Headquarters. Those who have no further use for any volumes of **TRANSACTIONS** on their bookshelves are requested to communicate with the **Book Department, American Foundrymen's Society, Golf and Wolf Roads, Des Plaines, Illinois.**

Positions Wanted

Foundry Sales Manager 16 years in steel foundry manufacturing and sales. Experience in low and high alloy, stainless steel, and ductile iron castings; also in shell molding and CO_2 processes. Well qualified to handle aircraft and missile quality castings. Knowledge of aircraft specifications, x-ray, heat treating, and radiographic inspection standards. **Box No. D-88, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY EQUIPMENT FOR SALE

1—Herman Molding Machine, Jolt—Roll—Draw, 4,000# series with 36" x 72" turnover plate—Oil and air tanks.
1—Centrifugal Casting Machine—complete with motor—5' Diameter, 42" high, 36" flask capacity.
1—Feeder Syntron 24" x 74" Type F-46, Style FO-726.
2—Squeezers—Osborn #212-PJ, 12" cyl. staty type.
1—Bumper—Osborn 36" x 48" Table.
1—Screening Unit—Simplicity 2' x 6' with motor.
1—Exhaust Fan—American Air Filter Type H 1400 CFM, 2200 RPM.
2—Stand Grinders—Double wheel 20" wheel with 3600 RPM. Motors.
1—Surface Grinder—Gardner #226 26" wet wheel.

The above equipment is slightly used and in good condition.

CORE WIRE & ROD

straightened and cut to your length

20 years of supplying black annealed and basic wire
Below Mill Prices

NORTHERN STEEL CORP.

1215-31 Walnut St., Erie, Penna. Ph 47-130
MFG. REPS. WANTED — Several Territories Open

Engineering Service

SESSIONS ENGINEERING CO.

Consulting Foundry Engineers
Modernization, Processing Layouts
Cost Reduction Quality Control
Product—Machine Control
Architectural Design
One North La Salle St., Chicago 2, Ill.

WESTOVER CORPORATION
Consultants
Exclusively serving the foundry industry since 1930
Mechanization—Modernization
Labor Relations—Incentives—Systems
Cost and Production Control
Plant Layout—Management
3110 W. Fond du Lac Ave., Milwaukee 10, Wisconsin

For Sale

Two Lindberg Radiant Fired Electric Furnaces complete with controls, 440 V, 50 KW. **ALUMINUM MATCH PLATE CORP., 1500 Military Rd., Buffalo 17, N.Y.**

Molding Machine: Herman 6000# capacity, jolt-roll-draw in operating condition. Asking $2,900.00 FOB **Pottstown Machine Co.,** Pottstown, Pa. (Phone 37, H. H. Houston).

FURNACES FOR SALE

10 used Heat-Treating Furnaces, and two 7-ton gantry cranes, good condition, priced to sell.

BAER STEEL PRODUCTS. INC.
Box 1428
Boise, Idaho

ELECTRIC ARC FURNACES FOR SALE Two—2000 lb side-charge furnaces complete with transformers, extra tops and electrodes. Low price for quick sale. **FRED H. WUETIG, 7445 South Chicago Ave., Chicago 19, Illinois. HYde Park 8-7470.**

Buy and Sell

When you are in the market for steel containers for shipping your products, **we have** them in sizes running from 15, 20, 24, 30 and 55-gal. Open Head, reconditioned, washed, and painted all black at reasonable prices, delivered your city in lots of 50 to 100. We also purchase empty 30 to 55 gallon core oil, lubricating oil and grease drums. Please advise how many you have so we can arrange to quote you prices f.o.b. your city. **NORTHWESTERN BARREL CO., 3111 Fifth Ave., South Milwaukee, Wis.**

MORE FACTS on all products, literature, and services shown in the advertisements and listed in Products & Processes and in For the Asking can be obtained by using the handy Reader Service cards, pages 7-8.

casting through the ages

advertisers and their agencies

This index is published as a convenience to the readers. While every care is taken to make it accurate MODERN CASTINGS assumes no responsibility for errors or omissions.

G.I.F.S. Announces Clinic for Training Salesmen

Gray Iron Founders' Society has announced a sales training clinic for gray and ductile iron castings salesmen to be conducted in Philadelphia, Chicago, Cleveland, and other cities to be announced. The sessions will be held early in 1958.

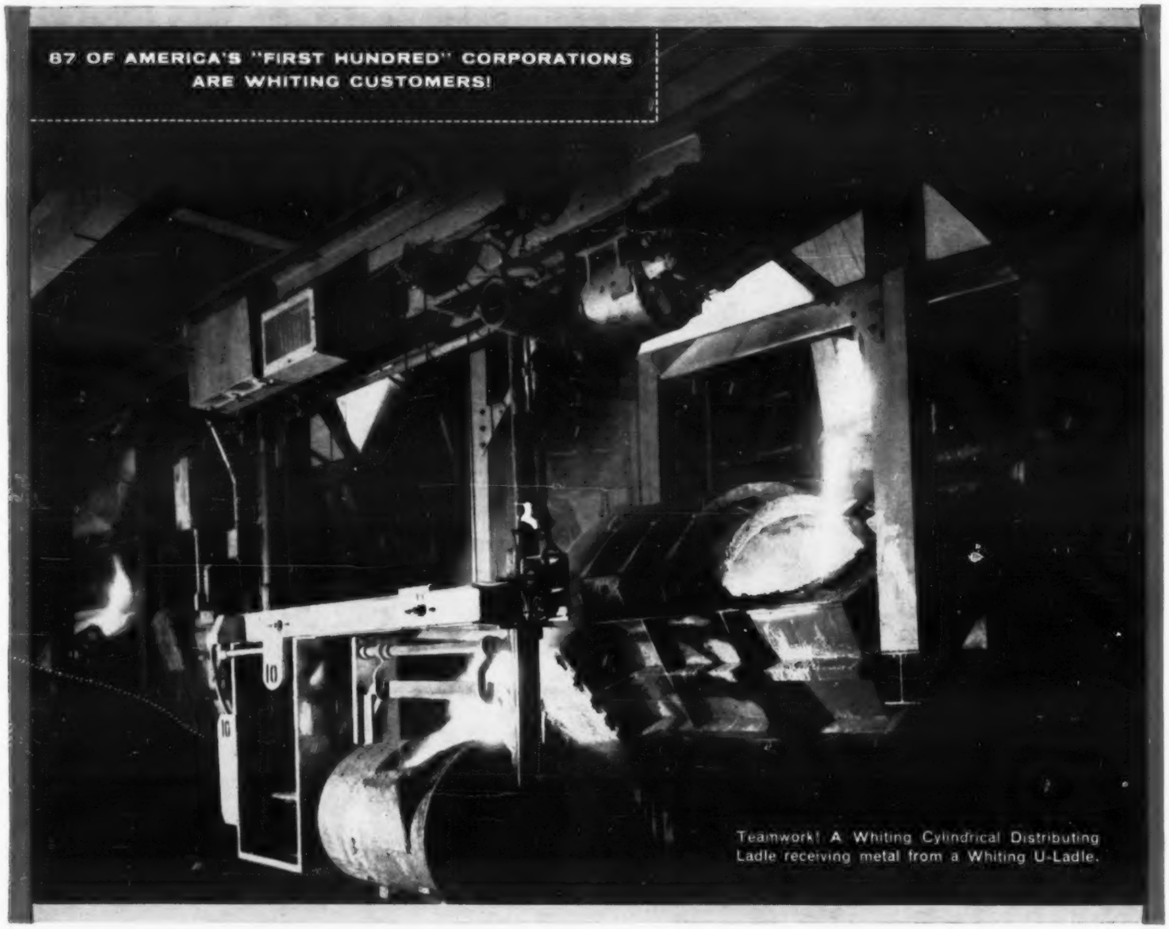
Subject matter will cover information needed by buyers of gray iron castings and industrial selling techniques. Company and technical product knoweldge will be studied; company sales presentations will cover policies, services, costing, engineering assistance, etc.

Technical sessions will include metallurgy, properties, design, pattern equipment, cast processes, and competitive materials.

Richard C. Meloy, Marketing Director, and Charles F. Walton, Technical Director, G.I.F.S., will direct the clinic.

Now Where Was That?

■ You will have no trouble locating articles in back issues if you write for the free index to 1956 issues of MODERN CASTINGS.



Teamwork! A Whiting Cylindrical Distributing Ladle receiving metal from a Whiting U-Ladle.

WHITING ENGINEERED LADLES...

For the Pouring Performance That Pays Off!

Pouring proficiency is an inherent quality in every Whiting engineered ladle.

That's because Whiting knows ladles . . . has more than 70 years experience in designing them to perform better, control easier, last longer.

Rugged, long-time favorites of foundrymen everywhere, Whiting ladles are built for highly specialized applications as well as for the more commonplace . . . and all feature the Whiting exclusives that speed pouring, bring new economy to cupola and electric furnace operations!

Send today for complete information on all Whiting ladles—hand and shank, covered trolley, covered crane, riveted crane, geared bottom-tap, non-geared up to 100 ton capacity, cylindrical, mixing and reservoir ladles. Ask for the booklet by name: "Whiting Ladles"

Whiting Corporation, 15628 Lathrop Avenue, Harvey, Illinois.

WHITING

FOUNDRY EQUIPMENT

MANUFACTURERS OF CRANES; TRAMBEAM HANDLING SYSTEMS; TRACKMOBILES; FOUNDRY, RAILROAD AND CHEMICAL PROCESSING EQUIPMENT